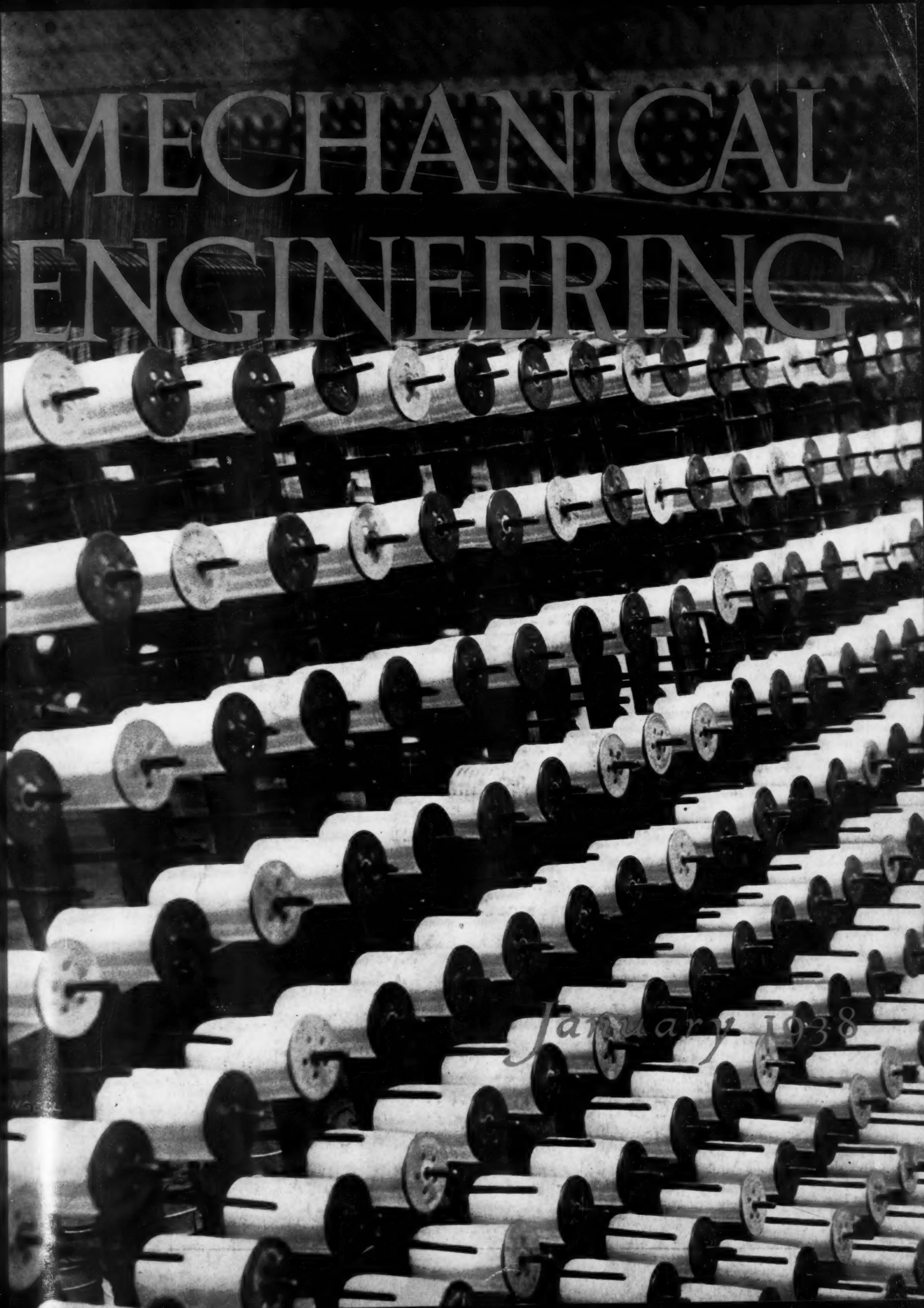
MECHANICAL ENGINEERING



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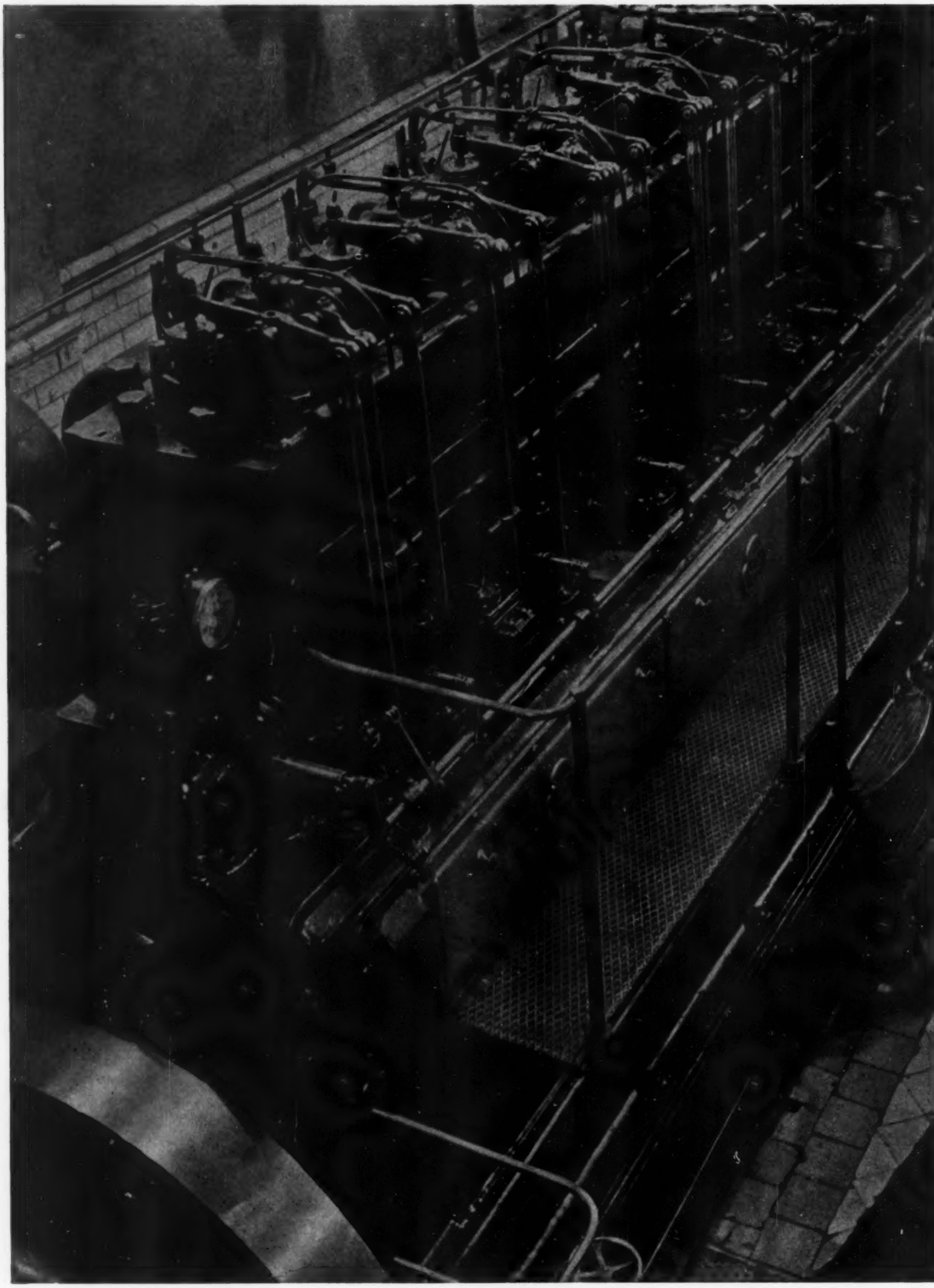


Diesel

(Photograph by G. R. Furman shown at Photographic Exhibit at 1937 A.S.M.E. Annual Meeting)

VOLUME 60
No. 1

MECHANICAL ENGINEERING

JANUARY
1938

GEORGE A. STETSON, *Editor*

Wider Use of Papers

FROM casual observation it may be estimated that the maximum number of persons who listened to the presentation and discussion of any one paper at the recent meeting of The American Society of Mechanical Engineers was less than 500. Comparing this figure with that of 20,000 representing, if students are included, close to the total membership of the Society, it is clear that relatively few members actually benefit from presentation and discussion. Fortunately, publication makes up for this otherwise inefficient method of disseminating knowledge. Fortunately, also, other schemes are available and in use by means of which the Society's papers are effectively used.

Anyone who looks through the stack of cards that comes daily from the Engineering Index realizes how widely A.S.M.E. papers are reprinted, in full and in abstract, by other agencies throughout the world. Through these agencies the Society's efforts to carry out one of its principal purposes—the dissemination of knowledge—is splendidly augmented, and the effectiveness of the Society's meetings is vastly increased.

But publication is not the only means by which technical papers are made available to engineers who are unable to attend meetings. All over the country engineers gather at local-section meetings and in local engineering societies and clubs. Junior members in a growing number of cities have organized themselves into groups for self-advancement. And under the guidance of honorary chairmen, student members in engineering colleges turn their attention to technical discussions that lie outside their regular class-room studies.

It is in these local gatherings of practicing-engineer members, of juniors, and of students that the papers read and discussed at Society meetings can and are being put to further use. Many times it is possible to persuade the authors of the papers to present them in person at these local gatherings. In other cases someone who has heard the presentation can lead a worth-while discussion of it. But even if the author or an engineer who has heard the discussion cannot be secured, the subject of the paper can be used as the basis of a meeting with helpful results.

The 1937 Annual Meeting was rich in material that engineers find keenly interesting. Leaders of local sections, junior groups, and student branches should not pass up the opportunity of making use of this material in their local programs.

Grounds for Optimism

SCIENCE and technology have made such sure and rapid advancement that engineers are impatient when they find how slowly the country at large accepts what seem to them to be the unquestioned benefits of the industrial system. For there can be no doubt of the fact that in industry exasperating misunderstanding and apparent antagonism among the groups involved operate to delay progress and incite ill will.

So much can be said on both sides that a sensible approach would seem to be a more intelligent appreciation by one group of the point of view of the other. Without tolerance and understanding we shall make slow progress. But undoubtedly when the country is thrown into a turmoil of conflicting views and interests in a period of social and economic unrest, such as we are passing through, we make faster and more certain headway than is possible in days of ease and relative contentment. In addition to the undoubted advances in technology, dramatically displayed at meetings of engineering and scientific societies and in the press, we may be grateful for evidences, simultaneously disclosed, that social and economic awareness is being awakened in engineers and engineering students. They provide grounds for optimism.

A New Era on the Sea

IT WAS on May 26, 1819, that the *Savannah* left the city of that name for Liverpool, the first ship equipped with steam boilers and engines to cross the Atlantic Ocean. To be sure, on her 29 days' voyage she raised steam only six times and ran her engines only 80 hours, but her trip began a century of steamship supremacy on the Atlantic. On Dec. 17, 1903, at Kitty Hawk, the Wright brothers made their first demonstration flight with a heavier-than-air craft under power. On Oct. 15, 1937, the United States Maritime Commission released a report in which this country was advised to turn its eyes away from superliners of the *Normandie* and *Queen Mary* type, and study the super flying boat as a means of rapid transatlantic travel in the luxury class. On Dec. 11, 1937, Pan American Airways Corporation, asked eight manufacturers to submit preliminary engineering sketches of 100-passenger flying boats capable of crossing from New York to Europe, nonstop, in 17 hours. These events, and others that complete the

cycle, are evidence of the steady advance of technology, with implications too numerous and far-reaching to be easily summarized.

Fortunately, the section of the Maritime Commission's report dealing with the superliner is abstracted in this issue, as is also (page 63) an article by George J. Mead, of the United Aircraft Corp., in which mention is made of the need for engines of 2000 to 3000 hp, for without engines of high power the large, fast, flying boat will be hard to produce.

The general requirements which the manufacturers are asked to consider include a pay load of 25,000 lb, a cruising range of 5000 miles, a cruising speed at sea level of 200 mph, stateroom, dining-room, and lounge facilities for 100 passengers, and accommodations for a crew of 16. After the preliminary engineering sketches have been considered, it is announced, manufacturers who have submitted feasible plans will be asked to prepare detailed designs and engineering specifications for new boats. It is hoped that the proposed boats will be in transatlantic service in 1941.

Thus, a daring and challenging objective has been set for the aircraft and engine manufacturers of this country—one which they have the courage to attempt; and no one who has followed progress in the field of aeronautics doubts that there exist the skill and ability of the manufacturers to achieve the ends sought. For a country whose frontiers have, according to popular belief, disappeared, the task ahead holds great encouragement. One wishes that economic and social problems could be so easily stated and could hold the promise of such immediate and satisfactory solutions.

A Realistic Report

ELSEWHERE in this issue (pages 55 and 56) will be found a résumé of the conclusions reached in the "Economic Survey of the American Merchant Marine," released on Nov. 10, 1937, by the United States Maritime Commission, announced in our issue of October, pages 767 and 768, and an excerpt from the Survey dealing with superliners and aircraft (pages 62 and 63). Engineers will find the 85-page report of the Maritime Commission interesting and informative reading, and will be impressed with the spirit of realism that pervades it.

The temptation is great to quote extensively from the report, not only because what it conveys is of great importance to the welfare of the country and of particular interest to engineers, but also because reports by government commissions are seldom marked with such flashes of realism as illuminate the pages referred to. The country has been subjected to a flood of reports covering fields of inquiry where imagination and idealism easily run riot. Such practical matters as expense involved are seldom considered in these reports where an appeal is made to social conscience without regard to economic justification or a consideration of the taxpayer who must foot the bill. Perhaps the grim realities of trusting themselves to the dangers of the ocean in ships of their own contriving have taught valuable lessons to men who follow the sea, not yet learned by the academic type of mind that has visions of social and economic utopias. In any event, one rubs one's eyes at the stark simplicity of some of the statements in the Maritime Commission's report.

For example: "The people have a right to know just where their money goes." "The Commission will decline to expend any part of this money without careful scrutiny of the objectives to be attained." When have we heard of such regard for other people's money? And there is no simple panacea: "It is obvious that a remedy for the ills of shipping is a compound of many ingredients." "Those taking part in the survey were instructed to take nothing for granted." And such bald truth: "The principal objection to subsidies, of course, is that they tend to misdirect capital and labor into uneconomic channels." What "old-fashioned" ideas about labor: "A merchant marine built upon inadequate and unsatisfactory personnel is little better than no merchant marine at all." "Order and discipline aboard American vessels must be restored; men must learn to abide by their articles, and to obey their officers. Officers must be mindful of their responsibilities." And lest the impression be gained that the attitude is hardboiled: "The shipping industry is now paying for its shortsightedness in repressing labor for so many years." "Continuous employment is the rule in most industries. It should be the rule in shipping."

Other passages indicate that the authors of the report have their eyes open and their feet on the ground. For example: "Problems regarding neutrality and possible international and civil wars necessarily involve so many unpredictable contingencies affecting shipping services that it is practically impossible to adopt plans for the future based upon them." "We are forced to the conclusion that every reasonable effort must be exerted to attract private capital, not only the capital of those who are under some pressure to protect investments already made in shipping, but also new capital from the public. Because the industry is ailing, because of the uncertainties of government policies, and, among other reasons, because of certain defects in the statute [Merchant Marine Act, 1936] there has been no rush of capital to the steamship business." "It is apparent that a prudent investor putting his funds into the construction of new American ships would ask himself whether the Government might, after his money has been changed into ships, cut out his operating-differential subsidy and leave him carrying, in competition with foreign shipping companies, the almost impossible burden of the excess costs of operation under our flag."

Enough has been quoted to emphasize the realistic type of thinking and expression displayed in the report. It is to be hoped that differences in opinion that undoubtedly exist in respect to the Commission's analysis and recommendations will be expressed with equal honesty and realism by those who hold them, and that politics will not hamper the working out of a sound shipping policy for the United States.

RETROSPECTION *and* PROSPECTION

Outstanding Events in A.S.M.E. Affairs in 1937 Presented as a Basis for Discussing Plans and Trends for the Future

By JAMES H. HERRON

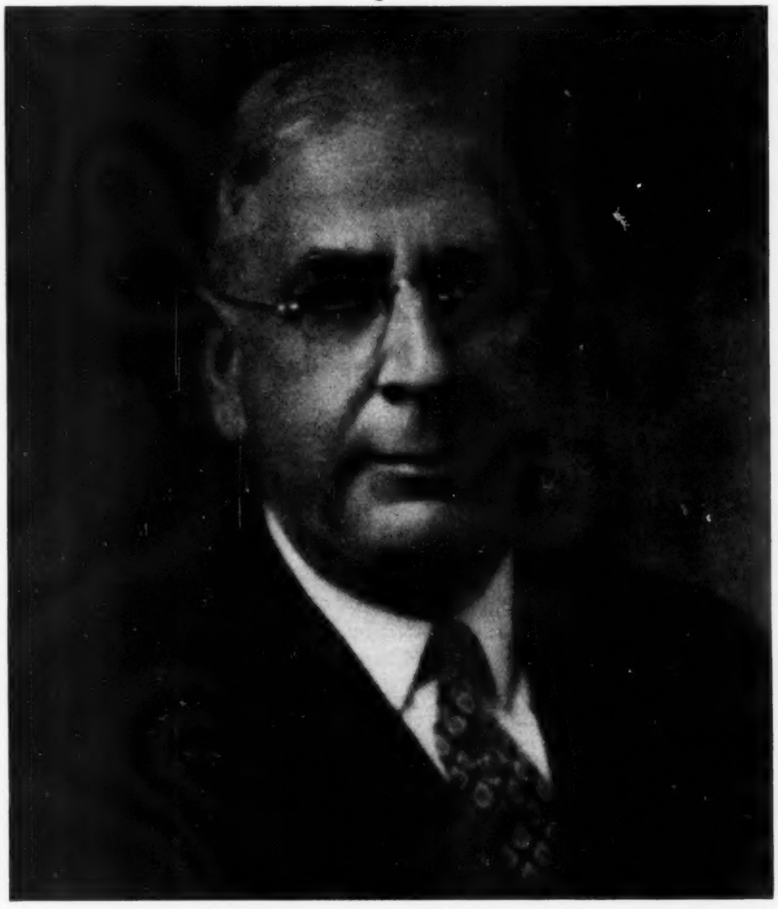
PRESIDENT, THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, 1937

THE LAST year has been one of marked activity and healthy interest in Society affairs. New obligations have been assumed and efforts toward their consummation have been attended with gratifying results. The virility of Society activity enables us to look into the future with increasing confidence. Based upon the experience of this year and guided by its teachings, we may be assured that whatever problems may arise there exist in our organization the spirit and ability to cope with them and to master them.

MEETINGS

The Annual Meeting terminates the program of the year to which it belongs, and, therefore, cannot be included for discussion in the annual address constituting a part of that meeting and contemporaneous with it. Accordingly, the Annual Meeting is the inheritance of the presiding officer next succeeding. For that reason it is proper to speak of the 1936 meeting although it was held under the presidential authority of my predecessor.

That meeting in 1936 was outstanding in its character. The momentous incidents that gave it significance centered about Dr. Ambrose Swasey who was duly honored as the banquet guest in commemoration of his having reached the ripe age of ninety years. Further, it was marked by the award of the Hoover Medal to Dr. Swasey. Another unusual feature was the presence of the Honorable Herbert Hoover, former President of the United States, who spoke in special tribute to Dr. Swasey. All of this was most fitting and timely in view of the subsequent passing of the honored guest to his eternal reward. It was the last opportunity that the assembled Society ever had of demonstrating to him personally the great esteem and high regard the membership, collectively and individually, was delighted to offer him.



JAMES H. HERRON
PRESIDENT, A.S.M.E., 1937

While the banquet was the high light of the occasion, the excellence of the technical sessions and honors bestowed at this meeting alone would have marked it as one of memorable sessions in the history of the Society. We can look back with unusual gratification on this event.

The Semi-Annual meeting in Detroit was characterized by the large attendance and the high-grade technical program. Plant visits, the presentation of the Holley Medal to Henry Ford, and the conferring of honorary membership in the Society upon Alex Dow were memora-

Presidential Address delivered at the Annual Meeting, New York, N. Y., Dec. 6–10, 1937, of The American Society of Mechanical Engineers.

ble features of this meeting. Many expressions of appreciation have been extended for the inspiration and personal gain derived by those in attendance. The influence upon the territory adjacent to Detroit has been very great, as your President has realized in visiting some of the Local Sections and Student Branches.

Initiating the new policy of four meetings a year, the first fall meeting was held in Erie, Pa., and offered a great opportunity for the Society to extend its usefulness. This meeting was well-attended, technical papers of a high order, and the plant visits of unusual interest. The addition of two meetings to the annual program means a large increase in the number of papers presented to the Society and available for distribution to the members in some form or other.

A spring meeting will occur at Los Angeles, Calif., and the Semi-Annual meeting will be in St. Louis. The fall meeting for 1938 is scheduled for Providence, R. I. The holding of four meetings a year will enable the members of different sections to participate more readily in a national Society meeting, and thus keep them in closer touch with Society affairs. It also removes that objection which has occurred in connection with members' feeling that they have been neglected because no meetings of major importance have been accessible in their particular zone. A proper distribution of these meetings throughout the country enables all members to enjoy the opportunity of attending at least once in every two years.

When the Society finances permit, preprints of papers should be available for these four meetings. Preprints will greatly aid those who are interested and add much to the value of presentation.

PUBLICATIONS

It must be borne in mind that the only contact of the Society with many of its members is through its publications. These publications are issued to all of the members and it is only fair that they contain matter of most widespread interest. Criticism has been made that MECHANICAL ENGINEERING is too technical, the critics asserting that it should contain only articles of universal interest, having a general appeal to all members irrespective of their specialization.

In view of this criticism your Publications Committee has done splendidly in correcting the conditions that existed and you will find MECHANICAL ENGINEERING can be read with understanding by all of the members of the Society. It is to be hoped that the Publications Committee continues this policy and adds to MECHANICAL ENGINEERING, as the opportunity presents, a greater number of items that will be of general interest and value. It is my opinion that the Transactions should continue to go to all members in order to guard against the possibility of any of our members missing an article of value to him.

It is my great desire that the Publications Committee may find its way clear in the near future to publish all papers presented at Society and section meetings, at least in mimeograph form as separates; to publish short notices or abstracts of these in MECHANICAL ENGINEERING; and to make them available to such members as desire them at a nominal cost. This would add something to the publication cost. It should be done in sufficient time to have the papers available for the meeting at which they are to be presented. I believe, however, that preprints of papers should be furnished for the four Society meetings only.

I am glad to say that no recent criticism has come to me regarding the publications of the Society, and I believe that past criticism has been satisfied by the changes in publication policy.

It has been suggested, and I feel keenly about it, that the Society should provide a handbook for the use of all members. This handbook could be issued in the beginning in loose-leaf form, appear later in a permanent binding, and be distributed to the members without cost. Doubtless sufficient advertising would be available to share at least a part of the publication cost. The articles for this handbook could be prepared by the members of the Society, and I feel confident that many would be glad to donate their services to this end. The officers of other societies which have established handbooks assure me that they consider them of the utmost importance in the feeling of members toward the Society. I believe action should be taken in the near future tending to the compilation of such a Society handbook.

LOCAL SECTIONS

I believe each member of the Society should be assigned to the local section most convenient to his residence. The local section is the only means affording affiliation and cooperation in community interests. A detached member is likely to miss much benefit to be derived from his association privileges, such as participation in the programs of the meetings; the feeling of intimate relationship in a group with a common interest; and the discharge of an obligation to his profession to the extent of his ability to serve. Both section and member improve their status by the mutual linkage. Allotment to local sections should be made to the greatest extent and at the earliest time possible.

The local sections should be encouraged in the future, as in the past, to cooperate with the local societies in their communities. This will tend to greater unity of the profession.

The local sections should be encouraged to have their programs ready at the beginning of the year. If possible these programs should be published to enable members of the sections to study their contents and to plan accordingly. This is already being done by some of the larger Sections.

Selection of the leaders of the local sections should be made considerately and carefully since much of the success of the section depends upon leadership.

The Group Conferences have been valuable both for the Society and for those members attending, since they have kept alive the spirit of cooperation among the sections and have succeeded in bringing to the Council the thoughts of the sections. However, there is a question

in my mind whether the Sections Conference, which was formerly held at the Annual Meeting, should or should not be resumed when finances permit. This should be a matter of careful study. Opinion in the field seems to be equally divided.

I think that, as early as possible, funds should be provided to pay all of the expenses of the representatives. These representatives give their time to Society interests and should not be called upon to provide their own funds for coming to the Society meeting where they devote a good portion of their time to the affairs of the Society.

I am also particularly interested in seeing that the Society return to the practice of alloting for sections' use 100 per cent of the money calculated by the formula. This will enable the sections to function and have such funds as they need in connection with their operation.

STUDENT BRANCHES

The student branches must of necessity become the source from which the future members are drawn. It has been particularly gratifying that the Council has taken action to extend a continuous membership from the student-branch to the member grade without transfer fee provided that the student so elects. This continuity of Society association is particularly important to the student.

The student branch is an important adjunct to the local section, and has shown splendid development, especially in recent years. One of the pleasures of the office which I have held this last year has consisted in visiting the student branches and seeing the enthusiasm which has prevailed. The Student Branch Conferences, where papers have been presented and prizes awarded, have been, in my opinion, outstanding events. They tend to encourage public speaking on the part of the student, as well as a logical development and presentation of the problem involved in the papers. It was my great pleasure to attend one of these conferences, and I came away with an added inspiration.

PROFESSIONAL DIVISIONS

As the professional divisions are charged with the responsibility of securing papers for the general meetings as well as for their own divisional meetings, I believe that these should be encouraged. Additional funds should be provided so that they may function more completely and with greater satisfaction. There has been a feeling on the part of some of these divisions that their importance has not had sufficient consideration. This situation should be carefully studied and corrected at the earliest possible moment. It has been my pleasure to attend several of these divisional meetings the last year and I have been impressed with the excellent feeling that has existed.

POWER TEST CODES

The preparation of power test codes is essentially a function of this Society and the excellent progress which has been made in the past should be continued. One thing, however, should be studied carefully and developed as soon as possible—some method of getting our members information concerning what has been accomplished in this work so that they may become familiar with what the Society has done along these lines. These power test codes cover a wide variety of interests and should prove a real medium through which to establish Society consciousness.

STANDARDIZATION

The excellent work done in standardization, especially that work sponsored by the American Standards Association I believe, is not fully appreciated by the members. This work is extremely desirable and forms the most extensive reliable data on the subject of standards of form in mechanical engineering. Active measures should be taken to set these accomplishments before our members and to call attention to such standards, thus enabling them to select those suitable for their use.

Many of our members are participating in the work of the American Society for Testing Materials in standards of quality. This should also be known to our members so that they may realize the extent to which our Society directs its efforts toward standards of both form and quality, and realize, too, that without our support these activities would not be possible.

RESEARCH

Research is one of the most important activities that we have to consider. For private and public means it has reached a large volume and is ever growing. The research of the future must go much further in the field than it has in the past. This is an agency which should be supported to the greatest extent of our ability. However, benefits of research are shared perhaps equally by manufacturers of equipment and members of the Society. It would, therefore, seem to be desirable that industry, as it now does, should subscribe generously to the solutions of these problems, which are made available to them, and the Society should bend its energies toward impressing industry with that fact.

COUNCIL

It will be of great interest for all members to read the report of the Council[1] showing the financial position of the Society and other matters of interest regarding the visits to sections and student branches of officers and senior councilors. I strongly urge that each member of the Society consider this Council report with much care. It will be more enlightening with respect to Society affairs than anything else which might be presented.

The last year has been one of great satisfaction and enjoyment to me. The Society has made substantial progress toward the ends of a better Society for its members. Under future administrations it will continue to move toward its ideal objective since those in charge of committee work are fully cognizant of the needs of the members in the field and are well aware of the means whereby they must be satisfied.

[1] See pages 9–18 of this issue.

UNITY *in the* ENGINEERING PROFESSION

By JAMES H. HERRON

PRESIDENT, THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, 1937

IN THE minds of many thoughtful engineers there has developed a vision of an all-comprehensive and coordinating head for the engineering profession. It has been thought that some plan can be devised for unifying the various organized bodies in this diversified field. Naturally, the question arises as to how it may be done; to what interest shall the appeal be made? Some think it can be along technical lines; others along material lines. This is a matter for careful study. We must look beyond our limited technical horizon into the fields occupied by our brother engineers.

Before the Iowa Engineering Society in 1935 Huber O. Croft delivered an address on the subject, "The Engineer and His Societies."[1] He stated that there are in this country more than 90 national organizations of engineers. He analyzed 20 such organizations having memberships ranging from 950 to 19,000, and aggregating about 100,000.

If the engineers of this country have such a diversity of technical interests as to demand so many societies, will it be possible for them to effect a complete unity on the basis of technical advantages? Will it be possible to gather them all under one roof, figuratively speaking? To bring them into a universal fold can be accomplished, but it can be done only through an appeal that touches the welfare of each individual. This appeal would seem to be the material interests of the profession. Along this line a beginning can be made toward professional unity.

We, as engineers, have been remiss in not utilizing the power that lies in the magnitude of our numbers, and in organizing and marshalling our forces to function in their maximum potential capacity. The intelligence and acumen of our membership have been comparatively dormant in recognizing the breadth of the field of opportunity and culpably slow in initiating activity designed to claim and secure the rewards which are justly ours. The American Medical Association, though slightly smaller in numbers than the aggregate of the 20 societies studied by Croft, is more strongly established for contributing its rightful obligation to social welfare and for securing for its members a proper recognition and respect of their professional status. In similar fashion the American Bar Association, with only about one third as many members, has established its power and influence in the minds of the people in the economic, social, and legal activities of the country to an extent that should be secured for the engineering profession. It can be secured, too, if inaction be converted into action, and indifference give way to stimulating interest. It is not enough that we should talk so much about it. Something should be done about it.

An organization of 100,000 engineers can command a powerful influence in any civic or social movement when presenting an unbroken front under the direction of such inspiring leaders as its ranks are able to supply. To unify and coordinate this legion into an organic entity requires a motivating purpose. Clearly the existing engineering societies can function best in the technical lines which differentiate them. In these matters they should continue and retain full and unrestricted power to carry out their aims. But in the material accomplishment of organized effort are interests which concern every engineer of whatever technical class. In these is a common ground upon which to build a structure of unity.

Assuming that we have established a need for unity and discovered a foundation upon which to build it, it is necessary to outline a plan for the superstructure most consistent with its purpose and least conflicting with the purposes of organizations now existing.

Two plans of unification have been suggested. One is to continue the present constituted societies, confining their activities to technical matters, and to add others to cover our material needs. The other is the plan of the American Medical Association. Under this system two branches cover the technical and material phases as Croft has proposed in his chart for a National Engineering Society. The plan provides for local and state organizations. Local societies would embrace all professional engineers in whatever branch they may practice, residing in a defined area. These local organizations would be united to form a state society to deal with all matters of common interest to engineers of that state. From the state societies the national organization could be effected.

An alternate plan which might be effective would utilize the societies as they now exist for technical purposes, but would also include an additional body to be organized by these societies to handle economic phases of the material welfare of engineers. This body might be independent of the present engineering societies and deal with material interests only.

One primary advantage of unity of the profession would be to prevent the coercion of our members by the unions. There seems to be a lack of information as to whether the engineering profession is or is not subject to the Wagner Act. Several members of engineering societies have joined unions. A single society is probably not strong enough to make an issue of this matter. However, it is clearly evident that all engineering societies must be made of such value that their members will not feel the necessity of resorting to some other agency in order to improve their economic condition.

An address delivered at the Annual Dinner, New York, N. Y., Dec. 8, 1937, of The American Society of Mechanical Engineers. Abridged.

[1] Mechanical Engineering, July, 1935, pp. 431–433.

To A.S.M.E. Members:

THE COUNCIL REPORTS FOR 1937

THIS ANNUAL Report of the Council presents a record of achievement and points to a future program of enriching the technical life of the Society, elevating standards of membership, and aiding recent engineering graduates. The Society is fulfilling its responsibilities to the profession at large by participating in a number of joint agencies for furthering the public welfare, enhancing the status of the engineer and aiding research. The activities of the Society and the joint agencies are summarized in this report.

The immediate program of the Council is built around these major objectives. The first of these is the broadening of the plan of Society meetings to four a year, national in character and widely spread geographically to give the individual members of the Society an opportunity to participate. This must of necessity be accompanied by a broader publication program.

A second is the need for improving the method by which applicants for membership and transfer are reviewed before being passed upon by the Council for admission to the Society. A large amount of time is being devoted to this by the Admissions Committee and the Council.

The third and possibly most important item of Society program concerns aid given by the Society to the young engineering graduate who is faced with the serious problem of adjusting himself to his engineering career. At the present time, organization of Junior groups has proceeded satisfactorily in 34 Sections. Their activities are being given a substantial amount of space in MECHANICAL ENGINEERING. Additional plans under consideration relate to a more formal scheme of instruction for these young men. During the past year 1435 engineering graduates came into the Society as Junior Members. To them the Society has a real responsibility to aid and help in the period of intensive post-college training through which they must pass before they become full-fledged engineers.

ADVANCES IN THE PROFESSION

The Society contributes to the unity and advancement of the engineering profession by participation in a number of agencies with other engineering societies similar to our own. These joint bodies engage in programs of significance to the future of the profession and the Council takes pleasure in including some of the high lights of accomplishment in this report so that members may have direct knowledge of them and may be stimulated to seek to know more about them.

Furthering the Public Welfare.

The American Engineering Council has completed seventeen years of existence as a joint organization of the engineering profession "to further the public welfare wherever technical and engineering knowledge and experience are involved and to consider and act upon matters of common concern to the engineering and allied technical professions."

The American Engineering Council is supported by 52 member bodies—30 local, 15 state, and 7 national of which The American Society of Mechanical Engineers is one.

During the last year the American Engineering Council concerned itself with several governmental problems of vital interest to mechanical engineers in industry and private practice. They include the National Bituminous Coal Commission and its Consumer's Counsel, the Patent office, the mapping program, government reorganization, consulting fees paid by the Federal Government, and the classification of salaries of government engineers.

Preliminary steps have

HIGH LIGHTS OF ACCOMPLISHMENTS 1936–1937

In the Society

Meetings: **Yearly schedule of four National Society Meetings set up. National Meetings held at New York, Detroit, and Erie.**

Publications: **MECHANICAL ENGINEERING and Transactions expanded and improved. Life of James Hartness, text on Hydraulic Structures, and nine codes, standards, and reports issued.**

Divisions: **Six divisional meetings held. Petroleum Division reorganized, cooperation with other technical bodies increased.**

Local Sections: **Seventy-two Sections held 688 meetings. New sections at Ithaca and Peoria organized.**

Student Branches: **One hundred and fourteen Student Branches with 4600 student members reported 594 meetings and 10 regional conferences.**

Finances: **With the exception of current accounts, the Society is free from debt.**

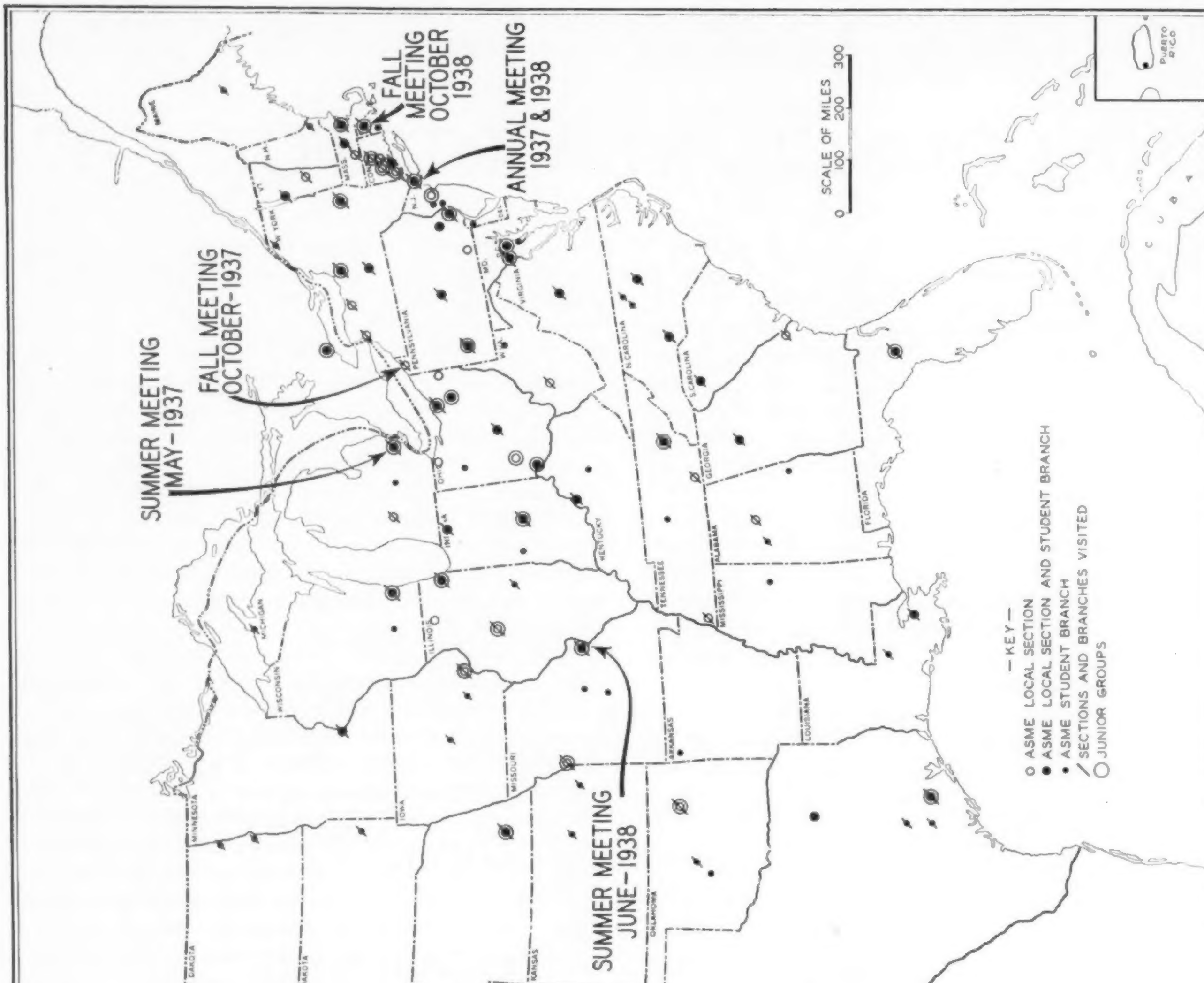
Constitution: **Major revision of constitution completed and published.**

In the Profession

Sound progress by American Engineering Council.

The practical completion of an accrediting program for undergraduate engineering curricula by Engineers' Council for Professional Development.

An additional gift of $100,000 to Engineering Foundation in the will of the late Ambrose Swasey.



THE GEOGRAPHICAL SCOPE OF THE SOCIETY'S PROBLEM. NOTE THE 34 JUNIOR GROUPS

been taken to form a working alliance with representative economists and other social scientists to consider subjects of broad significance to the public welfare.

United action has resulted in a survey of the economic status of engineers and engineering during the years 1929 to 1934 conducted by the Bureau of Labor Statistics at the request of the American Engineering Council. Abstracts of the survey reports appeared in MECHANICAL ENGINEERING during 1936 and 1937.

In the spring of this year a new edition of "Who's Who in Engineering" was published with the sponsorship and with the assistance of a special committee of the A.E.C.

Enhancing the Status of the Engineer.

In October, 1937, the Engineers' Council for Professional Development, an agency representing the technical societies, education, and the license boards, completed five years of its work to develop a program looking to the enhancement of the status of the engineer.

During the past year the most tangible accomplishment of E.C.P.D. has been the practical completion of the inspection of curricula and institutions in the program of accrediting undergraduate curricula in engineering. The program was started actively in 1935, and during the year, 39 of the 44 institutions in the New England and Middle Atlantic States asked to be accredited. In October, 1936, an initial list of accredited curricula was published. The program was then extended to the remaining regions and 88 of the 95 additional schools which submitted curricula were visited. Recommendations were made to E.C.P.D. on October 1, 1937, and shortly thereafter a national list of accredited curricula was published.

Furthering Research in Engineering.

The Engineering Foundation was founded in 1914 "for the furtherance of research in science and engineering or for the advancement in any other manner of the profession of engineering and the good of mankind."

Past-President Ambrose Swasey of this Society gave $750,000 for this purpose and during the past year, following his death in June, it was found that he had provided an additional amount of $100,000 as a trust for the use of the Foundation.

During the year the Foundation extended grants to aid the Engineers' Council for Professional Development and for research in the fields of the four Founder Societies. Grants to this Society were in aid of research on "The Effect of Temperature on the Properties of Metals," "Lubrication," "Critical Pressure of Steam Boilers," "Strength of Gear Teeth," and "Metal-Cutting Fluids."

Other Evidences of Cooperation in Engineering.

In addition to the bodies mentioned above, the Society cooperates with other engineering bodies in the United Engineering Trustees Inc., Engineering Societies Employment Service, American Standards Association, International Electrotechnical Commission, National Research Council, National Management Council, National Bureau of Registration, American Association for the Advancement of Science, and the Joint Division of Engineering History. It also participates in the administration of several joint awards: John Fritz Medal, Herbert Hoover Medal, Washington Award, Daniel Guggenheim Medal, Gantt Gold Medal, and Alfred Noble Prize.

During the last year the Society and the American Society of Civil Engineers secured contributions from American engineers to a memorial to be erected in England to Dr. William Cawthorne Unwin, Honorary Member of the two American Societies.

Details of these joint activities are included in the reports of the Committees of the Society and may be secured upon request by members.

THE SOCIETY

Technical Life of the Society.

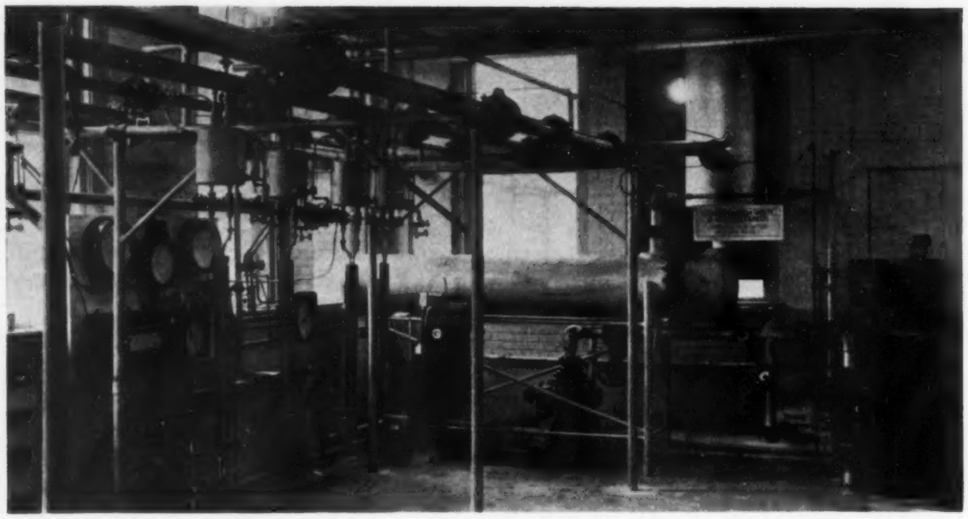
The principal purpose of the Society is to advance the art and science of engineering. Its continuing effectiveness depends on the success with which its meetings and publications are conducted and the value they hold for the individual member. There is an intangible value in the engineering ideas a member may carry away from a meeting, which cannot be measured in dollars, but which is reflected in the satisfaction and inspiration he gains from the fellowship at the meeting. One of the great traditions of the Society has centered around the uniformly splendid success of the great annual gathering of the members of the Society in New York every December. Leaders in all fields of the Society work have attended this meeting, participated in the discussion, and joined in its good-fellowship. To a slightly lesser extent this has also been true of the Semi-Annual Meeting which is held in a different locality each year.

To bring the meetings closer to the members, four Society meetings are to be held each year, national in scope and program. One will be held on the Pacific Coast, one in the great industrial area of the Middle West, one in or near New York, and one alternating between New England and the South. The plan was initiated with the Fall Meeting at Erie, Pa., on October 4 to 6, 1937.

During the past year, the meetings and technical activities were most successful. At three national Society meetings and at six meetings of Professional Divisions 251 papers were presented by 276 authors in 93 sessions before 4994 individuals. In addition 688 meetings were reported by Local Sections and 594 by Student Branches. The Society owes a debt of gratitude to all the authors and discussers who have given freely of their experience and time in the preparation and presentation of their papers. During the year 193 papers were published: 105 in Transactions and 88 in MECHANICAL ENGINEERING. In addition, ten papers were photo-offset and distributed to the Graphic Arts Division.

As a means of increasing the effectiveness of Society meetings and publications three standing committees of the Society have joined in recommending, as soon as finances permit, that the Society return to its former policy by which papers presented a meetings were set

THE GEOGRAPHICAL SCOPE OF THE SOCIETY'S PROBLEM. NOTE THE 34 JUNIOR GROUPS



FLOW-NOZZLE RESEARCH: METER LINES, MANOMETER, HEAT EXCHANGER, TEMPERATURE CONTROL TANK, AND PUMPS USED AT UNIVERSITY OF OKLAHOMA IN TESTS OF HEAD METERS[1]

(A project in which the A.S.M.E. Research Committee is interested.)

in type before the meeting, pamphlet preprints distributed for discussers, and the papers complete with the discussion and closure published in Transactions after the meeting.

The Committee on Meetings and Program stresses the need for encouraging voluntary contributions of technical importance for presentation at Society meetings which would render a distinct service to the Society and to the profession.

Members.

The table on this page shows the status of the members of the Society in each grade at the beginning and end of the fiscal year. The most interesting fact is the inclusion of Fellows in the tabulation for the first time. By vote of the membership, when the Constitution was revised in 1935, provision was made for the promotion to the Fellow grade of qualified past and present members of the Council. In accord with this provision 79 new Fellows were transferred from the Member grade during the year. Two of these were later promoted to Honorary Membership and four died, making the number of Fellows at the end of the fiscal year 73.

During the year the requirements for the new Fellow grade had been discussed at length by the Committee on Admissions and the Council, leading to the adoption by the Council, of an interpretation of the qualifications necessary for the Fellow grade. The Committee on Admissions has proceeded on the basis of this interpretation and recommended a number of applications for election. The Council will vote on them at its December meeting.

The number of Members and of Junior Members paying \$20 decreased during the year because of the action of Council in clearing up the delinquencies that have carried over. The large increase of Junior Members paying \$10 is the direct outgrowth of the splendid Student Branch activity which attracts a large number of new Juniors to the Society each year.

There are still 15 Associate Members on the list. These, however, will be promoted automatically to the grade of Member in accordance with the provisions of the Constitution that Associate Members on reaching the age of 30 shall become Members. Thereafter the Associate Member grade will disappear from the classification of Society membership.

Whereas the total membership shows a decrease of 73 for the year, the number of paid-up members on September 30, 1937, was 89 per cent, larger by 5 per cent than the corresponding figure at the end of the preceding fiscal

[1] This and other illustrations show some of the research projects in which the A.S.M.E. Research Committee is interested, as mentioned on page 16 of this report. For further information write for annual report of Committee.

CHANGES IN MEMBERSHIP

(October 1, 1936, to September 30, 1937)

	Membership		Increases			Decreases				Changes		
	Sept. 30, 1937	Oct. 1, 1936	Transferred to	Elected	Reinstated	Transferred from	Resigned	Dropped	Died	Increases	Decreases	Net changes
Honorary Members	14	17	2	...	...	...	...	...	5	2	5	− 3
Fellows	73	...	79	...	...	2	...	...	4	79	6	+ 73
Members	8,510	8,954	89	288	222	81	205	624	133	599	1,043	−444
Associate Members	15	15	...	...	...	...	...	...	...	...	...	...
Associates	246	265	5	1	9	...	12	18	4	15	34	− 19
Junior (20)	1,078	1,617	...	6	44	86	113	390	...	50	589	−539
Junior (10)	4,346	3,487	...	1,435	43	5	101	511	2	1,478	619	+859
Total Membership	14,282	14,355	175	1,730	318	174	431	1,543	148	2,223	2,296	− 73

year. Therefore, while the total membership shows a slight decrease the number of paid-up members is larger, and the Society membership is on a firmer basis.

The Committee on Admissions considered 2541 cases during the year—1909 being transfers from Student Member to Junior Member. At the end of the year 215 applications were in hand for consideration.

Council.

During the year members of the Council and the officers of the Society made unusual efforts to make contact with the active groups of the Society in the Local Sections and Student Branches. Following the policy inaugurated during 1935–1936, the Senior Member of the Council from each geographical area of the country was asked to assume responsibilities for leadership in that area. These responsibilities included visits to the Sections and the Branches.

During the year, members of the Council attended 10 Student Branch Conferences and 7 Sections Conferences, and visited 22 Sections and 10 Student Branches. In the fall of 1936 President Batt made an extensive trip to the Pacific Coast visiting 10 Sections and 13 Student Branches. During the first nine months of his term President Herron visited 17 Sections and 8 Student Branches and 1 Student Branch Conference. During the year the Secretary visited the Pacific Coast and during that time met with 13 Sections, 26 Student Branches, 1 Student Branch Conference, and 6 local engineering groups. At other times during the year the Secretary visited 13 Sections and 6 Student Branches. In addition, 22 sections were visited by the members of the Committee on Local Sections and 16 by the Assistant Secretary. The contact between the members of the Council and members has resulted in better understanding of Society policies and problems. The new plan of four Society meetings a year will give additional opportunities for the members of the governing body of the Society to keep in touch with the hopes and aspirations of the members.

As a further means of bringing the members of the council in closer touch with the operating problems of the Society, a Council member has been assigned to each of the Professional Divisions. It is hoped that this will prove as fruitful as the Local Sections and Student Branches contacts.

The Council will present at the Annual Meeting, a report verified by the President and Treasurer showing real and personal property owned by the Society, acquisitions and expenditures during the year, and a report by the Secretary giving names and places of residence of persons admitted to membership during the year.

Parker Case.

In last year's report mention was made of the decision by the New York Supreme Court in the visitation proceeding brought by Mr. Parker. In this decision it was found "that none of the property or funds of the Corporation (The American Society of Mechanical Engineers) have been misappropriated or diverted to any other purpose than that for which such Corporation was incorporated, and that such Corporation has not been engaged in any other business than that specified in its Certificate of Incorporation."

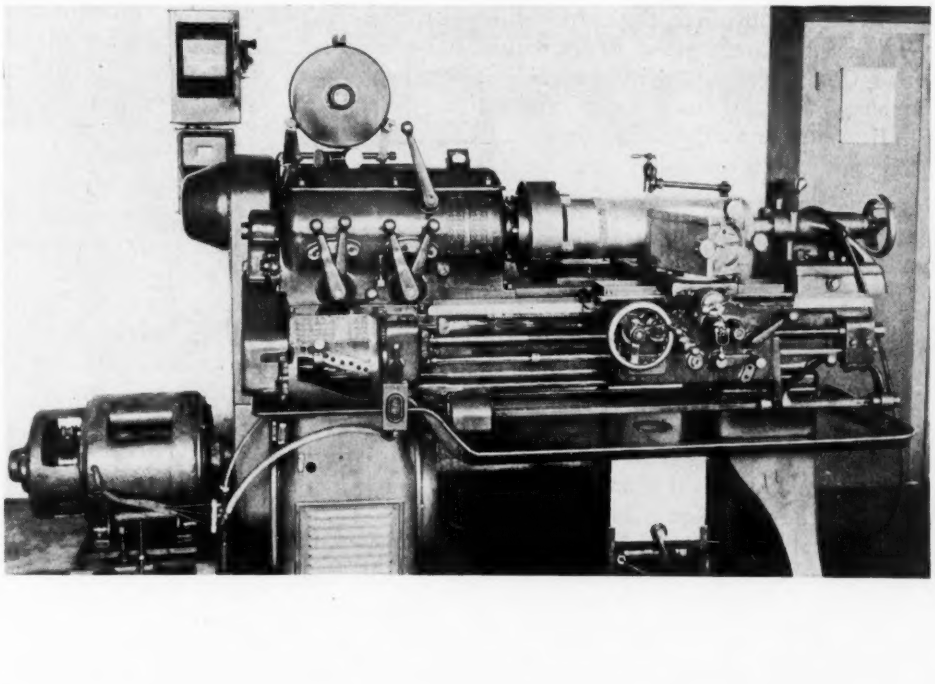
In spite of the findings of the Court Mr. Parker commenced another action against the Society and its Council in December, 1936, upon the same transactions which were fully covered by the Court in the visitation proceeding. This action is now pending.

ABSTRACTS OF COMMITTEE REPORTS

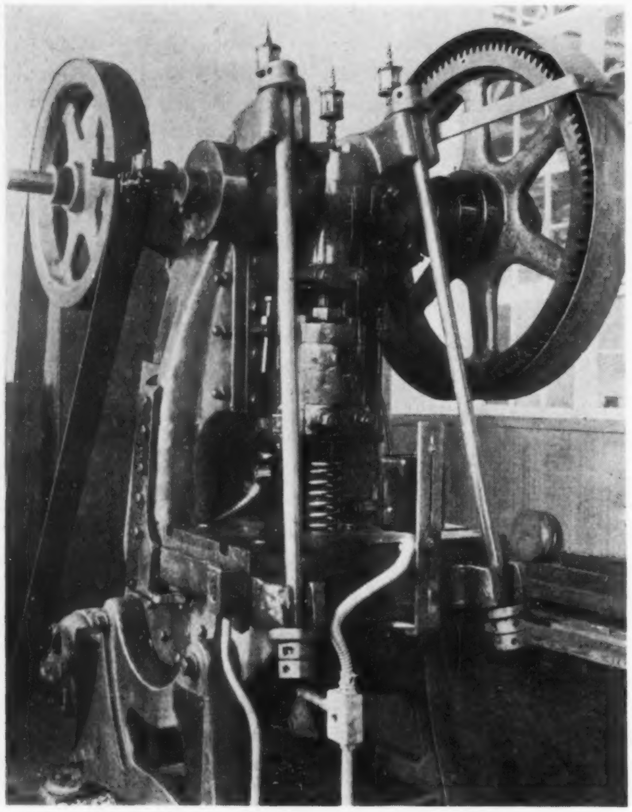
The complete reports to the Council of the Standing and Special Committees of the Society are available in full to every member of the Society upon request. Abstracts are given here so that members may have a concise view of the accomplishments of the year.

Publications.

Increased Society income, due in part to growth of revenues from advertising, made it possible for the Coun-



SMALL LATHE WITH CUTTING-FLUID TANK AND THREE-COMPONENT-FORCE DYNAMOMETER, DEPARTMENT OF METAL PROCESSING, UNIVERSITY OF MICHIGAN
(A project in which the A.S.M.E. Research Committee is interested.)



EXPERIMENTAL APPARATUS AT WRIGHT FIELD, DAYTON, OHIO, FOR FATIGUE TESTS OF HELICAL SPRINGS

(A project in which the A.S.M.E. Research Committee is interested.)

cil to enable the Committee on Publications more nearly to satisfy the demands upon it for the publication of papers presented at meetings and to improve the services rendered by MECHANICAL ENGINEERING.

Among the accomplishments of the year should be noted the publication in June of the biography of James Hartness, past-president of the Society, written by Joseph W. Roe. For the Graphic Arts Division the Committee published the proceedings of the 1936 Graphic Arts Conference. At the request of the Freeman Fund Committee and with the aid of the Fund, the Society published an English translation, by Samuel Shulits and Lorenz G. Straub, of the German book "Hydraulic Structures," by Armin Schoklitsch of Brünn, Czechoslovakia.

Regular publications, MECHANICAL ENGINEERING, Transactions, including the four issues known as the *Journal of Applied Mechanics*, and the Mechanical Catalog, were slightly enlarged as a result of better Society income. In addition to the Membership List, which included for the first time names of student members, the Society Record, issued as a supplement to Transactions, contained the indexes to Society publications, the revised Constitution and By-Laws and Rules, and memorial biographies of deceased members.

During the year ending September 30, 1937, 790 pages of technical papers and discussion were published in eight issues of the Transactions exclusive of the four issues devoted to the *Journal of Applied Mechanics*. The Society's Professional Divisions contributed 71 papers and its technical committees 10. In the *Journal of Applied Mechanics* 184 pages were published in the same period, comprising 24 technical papers, 8 pages of design data, 13 of research reviews, 15 of discussion of papers, and 36 book reviews.

Continued effort was expended on MECHANICAL ENGINEERING to improve its quality, usefulness, and appearance. Comment received shows that MECHANICAL ENGINEERING is making more friends with every issue.

The new section of MECHANICAL ENGINEERING has undergone further development. Into it has been incorporated the former Student Branch Bulletin. At the suggestion of Past-President Batt a "Members' Page" has been added. Increased activity among the junior groups has resulted in the appointment of a Junior Member to represent these groups and supervise the publication in MECHANICAL ENGINEERING of notes on their activities.

Beginning with the February, 1937, issue of MECHANICAL ENGINEERING "Briefing the Record," took the place of "Engineering Progress," Abstracts in "Briefing the Record" cover a wide variety of subject matter. An attempt is being made to prepare each abstract so that it will appeal to a large number of readers who wish to keep in touch with developments outside the fields in which their primary interest lies, on the theory that they are probably reasonably well informed in so far as their specialties are concerned.

Meetings and Program.

The outstanding development of the year has been the decision, approved by the Council of the Society to hold four national meetings annually, these to be designated Fall, Annual, Spring, and Semi-Annual. The major advantages to be expected from this plan are: (1) Simultaneous sessions of the Annual and Semi-Annual Meetings reduced; (2) a broader geographical distribution of meeting places.

The Annual Meeting of 1936 was unusual in many respects. Most important was the dedication of the banquet as a testimonial to Ambrose Swasey in honor of his ninetieth birthday. The Hoover Medal was conferred upon him, and Herbert Hoover, former President of the United States spoke in special tribute to Mr. Swasey. The Westinghouse Memorial Celebration was another striking feature of this meeting.

The Semi-Annual Meeting at Detroit was a decided success. Six general sessions were devoted to papers on the automobile industry and its contributions to other branches of engineering. A series of most interesting visits to plants supplemented the general and technical sessions of this Semi-Annual Meeting. And as high lights in the meeting, Henry Ford received the Holley Medal, and Alex Dow was made an Honorary Member of the Society.

The first in the new scheme of national meetings mentioned previously, a Fall Meeting, was held at Erie, Pa., on October 4 through 6. An excellent program and enthusiastic attendance ushered in the new plan.

Professional Divisions.

The 16 Professional Divisions of the Society reported increased activity during the year. Some progress was made in grouping the Divisions into five departments designated as (1) Basic Science, (2) Manufacturing, (3) Power, (4) Transportation, (5) Management and Administrative.

During the year the Standing Committee on Professional Divisions accepted greater responsibility in coordinating the technical programs for the national meetings of the Society, relieving the Committee on Meetings and Program of this detailed work.

Important items have been the reorganization of the Petroleum Division with 15 members in three groups of five each to represent the Atlantic, Pacific, and Mid-Continent areas; the Divisions have been willing to cooperate with other bodies interested in similar problems as is evidenced by the meetings of the Aeronautic Division in the Society of Automotive Engineers in Washington; the Graphic Arts Division with the Graphic Arts Research Bureau in New York; Process Industries Division with the Farm Chemurgic Council at New Brunswick, N. J., and the Textile Division with the National Rayon Conference, Washington.

Two excellent Divisional meetings were held during the year in addition to the four mentioned above. The Applied Mechanics and Hydraulic Divisions met at Ithaca in June and the Oil and Gas Power Division at State College, in August. In addition to these separate Division meetings all of the Divisions cooperated in preparing programs for the national Society meetings.

As the year drew to a close several Divisions were busy in preparation of meetings to be held in October after the opening of the 1937–1938 fiscal year. These included the Fuels Division meeting in Pittsburgh, the Machine Shop Practice Division in Atlantic City, the Textile Division in Boston, and the Wood Industries Division in Grand Rapids.

Local Sections.

During the year the Local Sections showed a substantial increase in activity, the number of meetings increasing from 596 in the previous year to 688 and the number of members in the Sections increasing from 12,434 to 12,696. Two new Sections were established, at Ithaca, N. Y., and Peoria Ill., the Meriden Section was consolidated with the New Britain Section and the Utica Section was disbanded. The total number is now 71.

The Local Sections are meeting the needs of the rapidly increasing number of Junior members by fostering Junior activities and Junior Groups. Thirty-four such groups have been organized and most of them show important activity.

One of the most productive activities of the Local Sections is the close cooperation that has been developed with Student Branches. The Sections have shown great interest in the nearby branches, have held joint meetings and inspection trips, have bestowed prizes for scholarship and good papers, and members have taken individual interest in Students.

Looking to the future, the needs of the Sections point to closer cooperation with Professional Divisions, better program-making and more thorough self-appraisal of the work of the Sections.

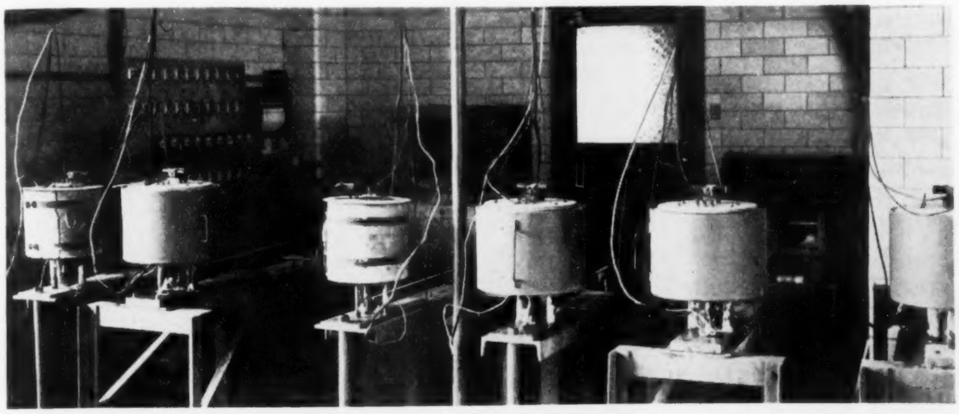
Delegates of Sections and Groups.

For the fourth year delegates from each Local Section met in seven geographical groups during October to discuss Society and Section problems and to voice members' views on these problems. Two delegates from each group met in New York during the Annual Meeting to consolidate their viewpoints and make suitable recommendations to the Council or to the committees concerned.

The important questions considered were the pending changes in the Constitution dealing with organization of Local Sections and with dues and transfer fees for Junior Members. On both questions the delegates were successful in securing the support of the business meeting and their views are represented in the Constitution now in effect. Other questions discussed included publications, licensing, Society budget, program-making in the Sections and junior activities. In addition the delegates agreed upon the names of the 1937 Society Nominating Committee which were presented to the Business Session for election.

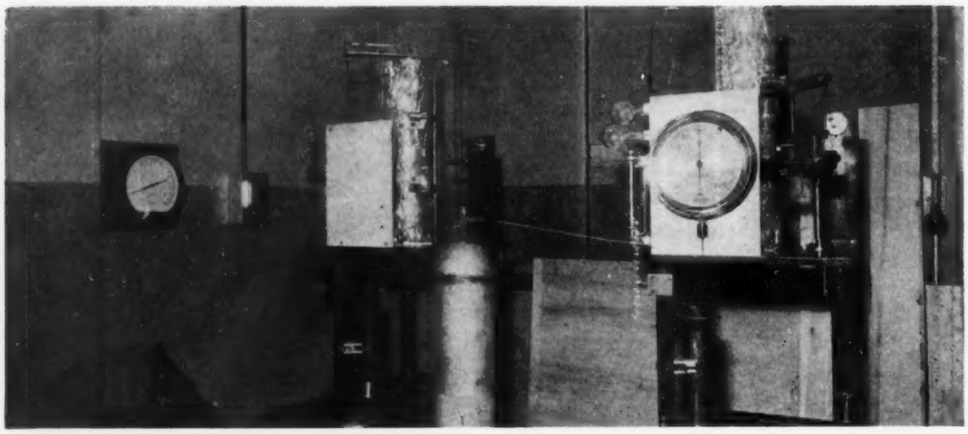
Student Branches.

The success of the A.S.M.E. Student membership plan is evidenced by the 4600 student members in 1936–1937 in 114 Student Branches, which reported 594 meetings. Student group meetings were held in ten geographical areas with an attendance of 1700 students and 150 faculty.



EFFECT OF WATER COMPOSITION ON BOILER STEEL; BATTERY OF MINIATURE BOILERS IN THE CHEMICAL ENGINEERING LABORATORY, U. S. BUREAU OF MINES, COLLEGE PARK, MD

(A project in which the A.S.M.E. Research Committee is interested.)



CREEP-TEST EQUIPMENT, DIVISION OF INDUSTRIAL COOPERATION, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

(A project in which the A.S.M.E. Research Committee is interested.)

The quality of the papers was high and the students displayed remarkable ability as public speakers.

The Committee on Relations With Colleges which administers the Student Branches also administers the Max Toltz Loan Fund. Last year $950 was loaned to seven students.

Library.

Thirty-seven thousand individuals used the Engineering Societies Library during the year, over 11,000 of them being assisted through correspondence. During the year 2734 volumes and 3700 pamphlets were added to the Library making the present size of the collection 141,292 volumes, 7330 maps, and 4362 bibliographies.

Committee on Education and Training for the Industries.

This committee took up the problem of education and training for engineering-college graduates in the industries by means of special apprenticeships and otherwise, and with the concurrence of the Committee on Relations With Colleges, secured Council approval of additional scope to cover its new activities.

Research.

The 24 special research committees have reported a fairly active year. Five of the committees sponsored technical sessions at the regular meetings of the Society at which a total of 21 research papers were read. The financial aspects of the several projects also show a normal amount of improvement. A total of $21,933.34, including $400 from The Engineering Foundation, was received from industry. An additional sum of $4600 in grants was given direct by The Engineering Foundation to certain of these committees which asked for support.

An outstanding accomplishment of the year was the completion of the third revision of "Part I, Fluid Meters—Their Theory and Application."

The following experimental researches have been under way throughout the year:

(1) A study of the flow nozzle at the National Bureau of Standards.

(2) The influence of cutting fluids on the cutting of monel metal and S.A.E. 2345 steel at the University of Michigan.

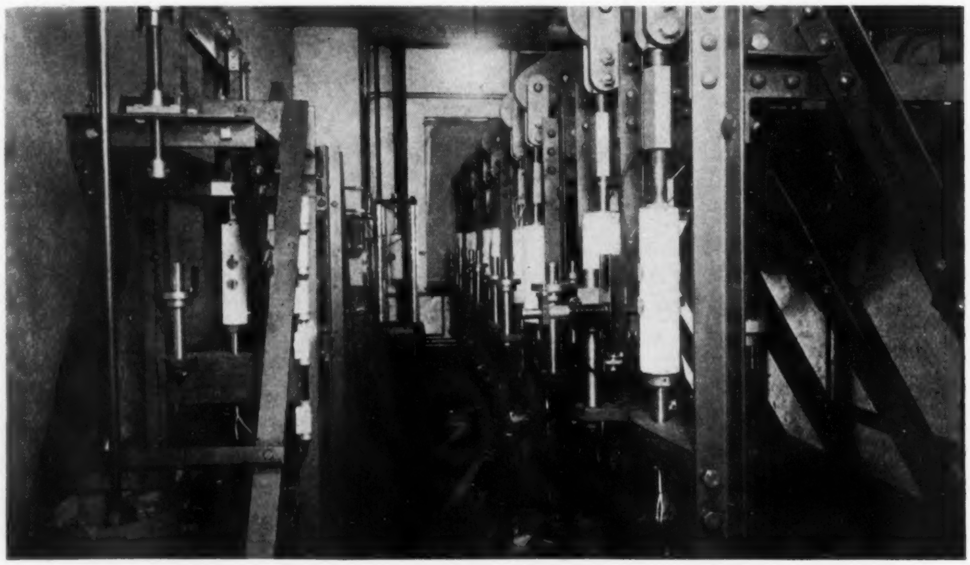
(3) Work on the fatigue properties of helical springs at Wright Field.

(4) Long-time creep tests on carbon steel, K-20, at the Battelle Memorial Institute.

(5) The effect of solutions on the cracking of boiler steel at the Nonmetallic Minerals Experiment Station of the Bureau of Mines, University of Maryland.

(6) Reaction between steam and metals, especially carbon and alloy steels, at high temperatures, at Purdue University.

(7) An investigation of full-scale cottonseed-oil mill operations in closed containers at pressures and temperatures higher than those now generally employed, at the University of Tennessee.



CREEP-TEST EQUIPMENT, BATTELLE MEMORIAL INSTITUTE, COLUMBUS, OHIO

(A project in which the A.S.M.E. Research Committee is interested.)

Standardization.

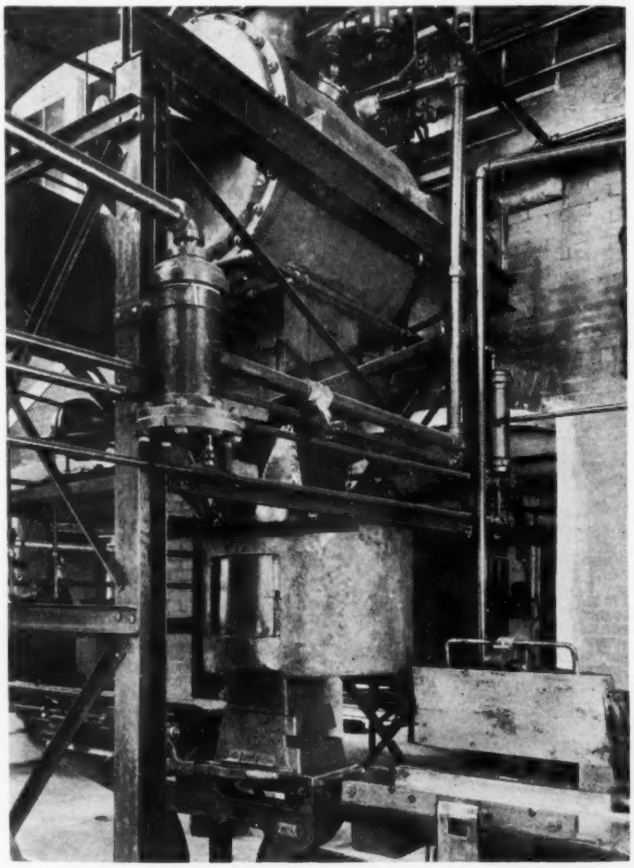
The technical committees engaged in the development of dimensional standards report a normal year of activity. The following four standards completed the required procedure and were submitted to the American Standards Association: Large Rivets, Machine Tapers, Adjustable Adapters for Multiple Spindle Drilling Heads, and Addendum to American Standard for Cast-Iron Long Turn Sprinkler Fittings.

Five standards were placed in the hands of the organizations which are sponsoring the several projects for approval and presentation to the A.S.A. and three others are before the members of the sectional committees for review and approval. Twenty additional projects are in the earlier stages of the procedure.

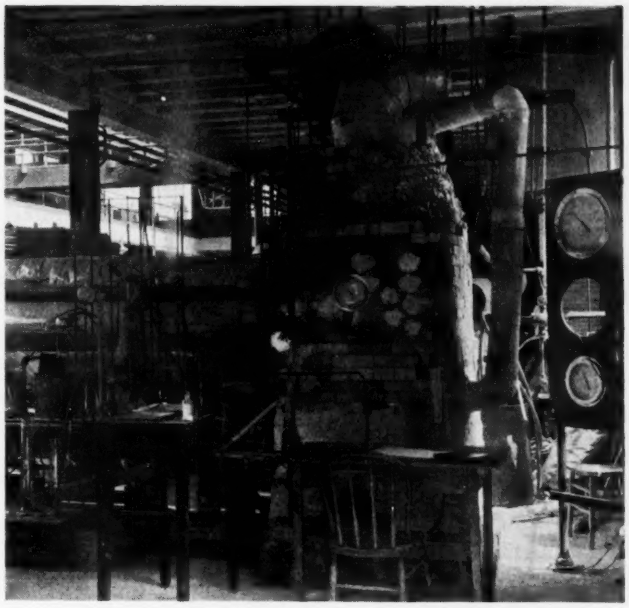
Power Test Codes.

To keep the A.S.M.E. Power Test Codes abreast of the best current practice the standing committee initiates revisions of the 21 individual codes whenever the need arises. This year four of its technical committees began the work of revising their codes.

The first editions or revisions of six other codes were practically completed, together with three sections of "Instruments and Apparatus." Finally, three sections of "Instruments and Apparatus" were published for the first time and one section was reprinted without change.



EXPERIMENTAL PRESSURE COOKER, ENGINEERING EXPERIMENT STATION, UNIVERSITY OF TENNESSEE, KNOXVILLE, TENN.
(A project in which the A.S.M.E. Research Committee is interested.)



CRITICAL-PRESSURE STEAM BOILER AT SCHOOL OF ENGINEERING, PURDUE UNIVERSITY, LAFAYETTE, IND.
(A project in which the A.S.M.E. Research Committee is interested.)

Safety.

The Standing Committee on Safety has kept before the membership the importance of conscious efforts to prevent accidents in industry and to set high standards of industrial hygiene. This year its activities have included (1) the holding of a technical session at the annual meeting, (2) the initiation of safety lectures to college students, and (3) the stimulation of the work of the several safety-code committees for which the Society is sponsor or joint sponsor.

Two publications, "Safety Code for Elevators," fourth edition, and "Elevator Inspectors' Manual" were completed, approved, and published.

Boiler Code.

This year the Boiler Code Committee held nine regular meetings during which it developed revisions and additions to various sections of the code. A real effort was made also to reduce the number of active interpretations by incorporating their intent in the text of the code.

Three important actions were taken during the year: (1) The adoption of new rules for the qualification of welding processes and testing of welding operators in the form recommended by a sister society; (2) the extension of the rules for fusion welding to apply to pressure parts of boilers other than drums; (3) the adoption of a new standard set of radiographs.

In preparation for future revisions two subcommittees have been studying safe allowable stresses for ferrous and nonferrous materials and a third has been developing rules to cover clad material for fusion-welded vessels.

Constitution and By-Laws.

The last year completed the major effort of the Committee on Constitution and By-Laws, namely, the first major revision of Society law since 1922. The new

Constitution was voted by the membership during the Spring, became effective on May 17 and was issued in July.

Honors and Awards.

During the year the following honors and awards were bestowed by the Society:

Honorary Membership to George A. Orrok, Hutchinson I. Cone, and Alex Dow
A.S.M.E. Medal to Edward Bausch
Worcester Reed Warner Medal to Charles M. Allen
Holley Medal to Henry Ford
Melville Award to H. A. Stevens Howarth
Junior Award to Harwood F. Mullikin, Jr.
Student Award, Undergraduate, to Leon B. Stinson
Student Award, Postgraduate, to Dewitt D. Barlow, Jr.

Freeman Fund.

The former policy of using the proceeds of the Freeman Fund to send travel scholars to Europe was modified and for a time the proceeds of the Fund are to be used in aiding the publication of an English translation by Samuel Shulits and Lorenz G. Straub of the German book "Hydraulic Structures," by Armin Schoklitsch of Brünn, Czechoslovakia.

Board of Review.

The Board of Review makes recommendations to the Council regarding the reinstatement of dropped members, resignations, and other related matters.

During the year the Board recommended a new policy in the handling of reinstatement of resigned and dropped members. This policy after approval by the Executive Committee of the Council has been distributed to the Section Officers and provides the basis for direct correspondence with the members who have resigned or have been dropped.

Aims and Objectives.

At the 1936 Annual Meeting the Committee on Policies and Budget was disbanded and in its place the Committee on Aims and Objectives has been organized with a membership chosen to obtain wider geographic distribution and a variety of Society interests. The Committee will initiate its work at the 1937 Annual Meeting.

Registration.

The Committee on Registration has recommended to the Council that the draft dated July, 1937, of the Model Law for the Licensing of Professional Engineers be approved and adopted by our Council.

Finances.

During the past year, several steps were taken toward increasing the Society's financial stability. Despite write-offs of publications inventory to a conservative value, and provision of 100 per cent reserve for dues receivable, surplus was increased by $6523.69. All outstanding certificates of indebtedness were called for redemption on July 1. With the exception of current accounts on September 30, 1937, the Society is free from debt.

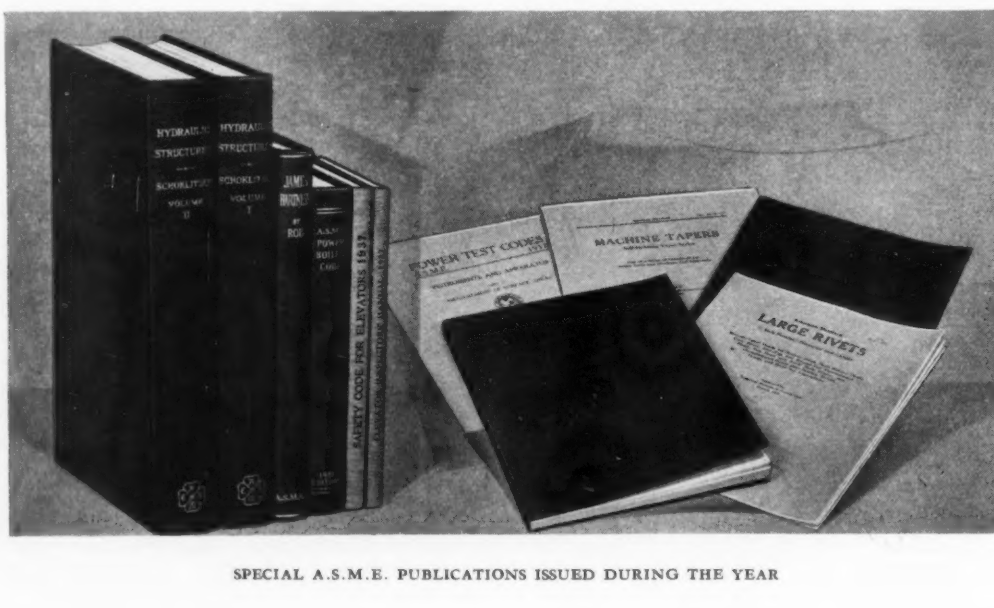
The complete report of the Finance Committee which follows the Council report is worthy of careful study.

DEATHS

During the year, the Society lost by death five Honorary Members: Ambrose Swasey, Henri le Chatelier, Sir John A. F. Aspinall, Elihu Thomson, Charles de Fréminville, also a Council member-elect, Jas. A. Hall, and two officers of joint bodies of which the A.S.M.E. was a member body, Dr. Alfred D. Flinn, director of the Engineering Foundation, and Gen. Robert I. Rees, vice-chairman of Engineers' Council for Professional Development.

CONCLUSION

While a perusal of the foregoing reports brings a realization that the Society is carrying on its work successfully, the Council will welcome all suggestions from members as to ways in which the service of the Society may be improved.



SPECIAL A.S.M.E. PUBLICATIONS ISSUED DURING THE YEAR

A.S.M.E. FINANCE REPORT 1936-1937

CHANGES in surplus during the last year are shown in detail in Exhibit "B." For the past five years, the Society's end-of-year surplus has been:

September 30, 1933	$205,303.71
September 30, 1934	222,596.59
September 30, 1935	238,849.45
September 30, 1936	143,885.96
September 30, 1937	150,409.65

Previous to 1936, investments were carried at cost. In 1936 change was made to market value, reducing surplus by $137,423.03. In 1937 there was a further reduction of market value of $1525.

Policies of preceding years have been continued with the purpose of bringing the surplus to as conservative a value as possible.

In the current year, outside of initiation fees and current excess of income over expense, the chief factors affecting surplus are:

Write-off—publications inventory	$22,923.55
Reserve provided—dues receivable	14,182.18

The increase in reserve for dues receivable provides a 100 per cent reserve for that item.

To maintain a conservative value for the publications inventory, without affecting future surplus, a more conservative policy of establishing cost prices for publications stored has been put into effect and provision is made in the budget for additions to reserve for publications inventory write-off.

LIBRARY

The United Engineering Trustees reported a recent appraised value of the library books belonging to the Founder Societies, as $480,800. The American Society of Mechanical Engineers' substantial share of this amount has been written down and has been carried on the books at $1 since 1926.

CURRENT OPERATIONS

No money was borrowed from the banks during 1936–1937. All outstanding Certificates of Indebtedness were called on May 26, 1937, for redemption on July 1, 1937. With the exception of current accounts on September 30, 1937, the Society is free from debt.

TRUST FUNDS

The restoration of trust-fund assets to their original value is an important problem before the Finance Committee, and recommendations will be forthcoming in 1937–1938. The Finance Committee believes that a program for restoring trust-fund values should be put into effect before there is any expansion of Society activities.

MORTGAGE CERTIFICATES

Mortgage certificates of Lawyers Mortgage Company remain the chief items of Society investment and trust-fund portfolios. The cost of these certificates as shown last year was $298,642.85. The then appraised value was $167,381.96. During the current year $988.59 has been redeemed leaving a cost value remaining of $297,654.26. As the present appraised market value is substantially the same as at September 30, 1936, no further adjustment as to write-down was necessary.

The cash income received during the year from these certificates was $16,854.51, including accruals. Nearly all of the mortgages underlying these certificates have been reorganized. Average percentage yields on real-estate mortgage bonds and certificates were:

	Trust-fund assets	Society invest-ments	Aggregate
1933–1934 based on cost	4.46	3.37	3.64
1934–1935 based on cost	4.13	3.59	3.75
1935–1936 based on cost	4.20	3.40	3.60
1936–1937 based on cost	5.80	4.51	4.84
1935–1936 based on market	8.11	6.73	7.09
1936–1937 based on market	11.24	8.96	9.55

STATEMENT OF PRESIDENT AND TREASURER

In accord with the provisions of the Constitution, the President and Treasurer have signed a statement of assets and property of the Society which is to be presented at the Annual Business Session of the Society on December 6, 1937, and filed with the records of the Society.

W. T. CONLON, *Chairman*
K. M. IRWIN, *Vice-Chairman*
K. W. JAPPE
J. J. SWAN
J. L. KOPF
Council Representatives:
W. A. SHOUDY
W. L. BATT

ACCOUNTANTS' CERTIFICATE

TO THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS:

We have made an examination of the balance sheet of The American Society of Mechanical Engineers as at September 30, 1937, and of the summary of income and expenses and statement of surplus for the year ending that date. In connection therewith, we examined or tested accounting records of the Society and other supporting evidence and obtained information and explanations from an officer and employees of the Society; we also made a general review of the accounting methods and of the income and expense accounts for the year, but we did not make a detailed audit of the transactions.

We have accepted as correct the balances in the accounts at September 30, 1936, and the summary of income and expenses for the year ending that date as shown by the books and by a report of other public accountants.

In accordance with the practice followed by the Society in prior years, no effect has been given in the statements to accrued income on investments.

The membership dues are included in the income account of the current year on the basis of total cash received on account of that year and prior years, and provision has been made by a charge to surplus for all dues uncollected at September 30, 1937.

In our opinion, subject to the foregoing, the accompanying balance sheet and related summary of income and expenses and statement of surplus fairly present, in accordance with accepted principles of accounting consistently maintained by The American Society of Mechanical Engineers during the year under review, its position at September 30, 1937, and the result of its operations for the fiscal year ending that date.

New York,
November 1, 1937

(Signed) PRICE, WATERHOUSE & CO.

EXHIBIT A—BALANCE SHEET, SEPTEMBER 30, 1937

ASSETS

GENERAL FUND:			
Cash in banks and on hand			$ 61,047.46
Accounts receivable:			
Dues, current year	$17,674.95		
Dues, prior years	4,342.25		
	$22,017.20		
Less—Reserve	22,017.20		
Publications and advertising	$47,610.54		
Less—Reserve	3,290.89	$ 44,319.65	
Miscellaneous		1,783.64	46,103.29
Note receivable			199.36
Inventories:			
Publications completed		$ 17,725.29	
Publications in process		7,720.51	
		$ 25,445.80	
Less—Reserve		1,500.00	
		$ 23,945.80	
Supplies		3,576.95	27,522.75
Securities (at approximate quoted market value):			
Real-estate mortgage bonds and certificates		$121,013.37	
Railroad bonds		2,475.00	123,488.37
Deferred charges			295.00
			$258,656.23
EMPLOYEES' RETIREMENT FUND:			
Cash in banks		$ 617.83	
Real-estate mortgage certificate (at approximate quoted market value)		11,050.00	11,667.83
TRUST FUNDS:			
Cash in banks		$ 23,097.32	
Notes receivable (Major Toltz Fund)		5,240.89	
Corporate stocks and real-estate mortgage certificates (at approximate quoted market values)		58,861.00	
			87,199.21
PROPERTY FUND:			
One-fourth interest, real-estate, other assets, United Engineering Trustees, Inc., exclusive of trust funds		$498,448.48	
Office furniture and fixtures (depreciated value)		24,613.37	
Library books		1.00	
Engineering Index—Title and good will		1.00	
			523,063.85
			$880,587.12

LIABILITIES

GENERAL FUND:		
Certificate of indebtedness and accrued interest thereon		$ 510.00
Accounts payable		11,920.53
Accrued liabilities:		
Estimated liability relating to Mechanical Catalog for 1937–1938	$ 15,076.67	
Others	5,917.45	20,994.12
Unexpended balances of Custodian Funds		24,577.66
Deferred credits:		
Dues and initiation fees paid in advance	$ 45,590.57	
Prepaid subscriptions	4,000.00	
Prepaid advertising	653.70	50,244.27
Surplus (Exhibit C)		150,409.65
		$258,656.23
EMPLOYEES' RETIREMENT FUND		11,667.83
TRUST FUNDS:		
Principal	$ 70,262.35	
Income	16,936.86	
		87,199.21
PROPERTY FUND		523,063.85
		$880,587.12

NOTE: Initiation and promotion fees receivable are not included in the above statement as they are taken up by the Society only as and when collected.

EXHIBIT B

COMPARATIVE SUMMARY OF INCOME AND EXPENSES

For Two Years Ending September 30, 1937

	Year 1936–1937	Year 1935–1936
INCOME:		
Initiation and promotion fees (to surplus)	$ 8,726.90	$ 8,961.44
Membership dues*	$215,908.83	$198,209.83
Student dues	13,560.50	11,411.50
Interest and discount	12,315.13	10,451.11
MECHANICAL ENGINEERING advertising	81,408.21	63,716.04
Mechanical Catalog advertising	48,865.63	47,547.59
Publication sales	54,359.45	53,980.60
Miscellaneous sales	1,966.75	1,808.00
Contributions, *Journal of Applied Mechanics*	875.00	1,490.00
Contributions, unrestricted	554.37	373.98
Registration fees	261.00	245.00
Sale of equipment	233.50	117.00
Loss on sale of securities	−117.12	−120.00
TOTAL INCOME	$430,191.25	$389,230.65
EXPENSES:		
Expenses under committee supervision	$ 77,687.30	$ 74,618.86
Publication expense (including provision for uncollectible accounts receivable other than dues; 1936–1937, $1870; 1935–1936, $2238.05)	128,469.68	108,571.91
Office expense	191,212.79	185,098.26
TOTAL EXPENSES	$397,369.77	$368,289.03
Net income for year	$ 32,821.48	$ 20,941.62

* Membership dues have been stated for the year 1936–1937 on the basis of total cash received on account of that year and prior years.

EXHIBIT C

STATEMENT OF SURPLUS

Year Ending September 30, 1937

BALANCE, September 30, 1936		$143,885.96
ADD:		
Initiation and promotion fees collected	$ 8,726.90*	
Net income for year (Exhibit B)	32,821.48	
Adjustment of reserve for accounts receivable, advertising	3,500.00	
Adjustment of reserve for life memberships	706.04	45,754.42
TOTAL		$189,640.38
DEDUCT:		
Write-off of obsolete and unsalable publications, etc.	$ 22,923.55	
Transfer to reserve for dues receivable, to reserve in full for dues outstanding at September 30, 1937	$ 14,182.18	
Transfer to trust funds: Jackson and Ricketts gifts received in a prior year	600.00	
Write-down to approximate market value of securities owned at September 30, 1937 (exclusive of write-down of $3001 in respect of trust-fund investments, charged against trust-fund reserve)	1,525.00	39,230.73
BALANCE, SEPTEMBER 30, 1937		$150,409.65

* As it is the practice of the Society to take up initiation and promotion fees only as and when collected, the above statement does not include such fees receivable at September 30, 1937.

DETAILED COST OF A.S.M.E. ACTIVITIES, 1936–1937

	Expense under committee supervision	Printing and distribution expense	Office expense	Total cost 1936–1937	Total cost 1935–1936
Council	$ 4,384.53			$ 4,384.53	$ 5,678.28
Library	8,399.52			8,399.52	8,497.08
Library Stacks	1,500.00			1,500.00	
American Engineering Council	9,750.00			9,750.00	10,000.00
Engineering Council for Professional Development	850.00			850.00	450.00
Finance Committee Expense	110.39			110.39	
Awards	439.30			439.30	793.95
Nominating Committee	480.81			480.81	662.24
Constitution and By-Laws	774.88			774.88	107.83
Local Sections	20,552.25		$ 7,822.62	28,374.87	29,333.16
Meetings and Program	6,396.77		3,725.10	10,121.87	8,929.77
Professional Divisions	2,453.97		3,725.10	6,179.07	6,328.73
Admissions			7,201.34	7,201.34	6,793.08
Employment Service	4,249.92			4,249.92	8,702.84
Student Branches	8,031.43	$ 3,228.26	6,360.35	17,620.04	18,364.43
Technical Committees	500.00		18,579.56	19,079.56	17,524.59
MECHANICAL ENGINEERING Text Pages		25,721.61	10,457.36	36,178.97	32,623.05
Transactions and *Journal of Applied Mechanics*	164.59	28,504.45	10,100.77	38,769.81	37,172.45
Membership List		6,528.51	2,122.10	8,650.61	
MECHANICAL ENGINEERING Advertising Pages		18,424.99	23,337.20	41,762.19	34,625.43
Mechanical Catalog		19,302.00	17,192.58	36,494.58	32,484.04
Publications for Sale		26,759.86	8,393.79	35,153.65	32,802.95
Retirement Fund	4,080.00			4,080.00	
Parker Case	888.88			888.88	1,908.25
Interest on Certificates of Indebtedness	918.50			918.50	2,073.99
Professional Services	1,511.56			1,511.56	3,238.58
Calvin Rice Memorial	250.00			250.00	
International Management Congress	1,000.00			1,000.00	
Secretary's Office			16,432.25	16,432.25	15,732.16
Accounting			13,109.44	13,109.44	13,674.61
General Service			25,307.22	25,307.22	26,281.94
General Office Expense			17,346.01	17,346.01	13,505.60
TOTALS	$77,687.30	$128,469.68	$191,212.79	$397,369.77	$368,289.03

Progress in RAILROAD MECHANICAL ENGINEERING *in* 1937

Part II—Diesel and Electric Developments—New Car Designs

DIESEL MOTIVE POWER IN THE UNITED STATES AND CANADA

Domestic Diesel-locomotive orders in the first three quarters of 1937 reached the record number of 93; 3 of these were 3600-hp double units and the remainder were switchers of 300 to 900 hp and, preponderantly, of 600 hp. While the number of units thus attained 56 per cent of the steam-locomotive orders, their power aggregates only about one tenth of the steam-locomotive horsepower but nevertheless reaches the remarkable figure of about 70,000 hp. No new Diesel streamlined trains were ordered and no self-propelled cars, but six 1200-hp streamlined trains, ordered late in 1936, were placed in service.

Several interesting papers discussing maintenance problems and cost were recently presented (58, 59, 60),[1] beginning to throw light upon these essential questions. The successful operation of the high-powered long-distance streamliners from Chicago to the Pacific Coast requires the continual presence of two mechanics who occasionally are called upon to replace a piston, sleeve, or cylinder head en route while part of the power plant is shut down, and in combination with exacting provisions for attending these trains at terminals, monthly mileages of 21,000 to 25,000 are reached in the Pacific Coast service, and even more in the Chicago-Denver service. These figures are not matched anywhere abroad.

In May, the Santa Fe received from the Electro-Motive Corporation its second 3600-hp double-unit locomotive, Fig. 18, for hauling the newly appointed *Super Chief* (61). Compared with the engine of 1935, the major change was from four to six-wheel trucks, reducing the average axle load from 63,500 to 47,300 lb, although the total weight rose from 508,000 to 568,000 lb. Axle load is thus 12 per cent below that of the front truck of the present *City of San Francisco*. The 36-in. wheels were retained. Power plant consists of four standard two-cycle engines with twelve 8 × 10-in. cylinders as in all of last year's high-powered streamliners, developing 900 hp at 750 rpm. The engines have needle-bearing wrist pins and Satco-lined main bearings, aluminum pistons, and drop-forged connecting rods. They are coupled to 600-volt direct-current General Electric generators, likewise standardized and feeding eight traction motors. Two 90-hp auxiliary sets of the earlier locomotive have been abandoned, and the air compressors are driven directly from the generator shafts. The two flash-type steam-heating boilers have been enlarged from an aggregate capacity of 4000 lb per hr to over 4500 lb at 225 lb pressure. Fuel capacity is 2200 gal, as compared with 1600 gal for the earlier locomotive, and water capacity, 1200 gal. Diesel horsepower is 12.7 per ton of locomotive weight, and shaft horsepower of the electric motors, which is comparable to indicated horsepower in a steam locomotive, is 9.5 per ton if the losses through electric transmission and engine auxiliaries are estimated at 25 per cent. With the nine-car lightweight train of 426 tons net service weight, the locomotive weighs 62 per cent of the trailing load and the net horsepower is 3.8 per ton or 5.07 hp gross, which indicates that climbing speed on grades and acceleration in the higher-speed regions is necessarily low.

Two 3600-hp locomotives, identical with the foregoing in design and wheel loading, were delivered to the Baltimore & Ohio in June, for service on the *Royal Blue* and *Capitol Limited*, and two more were ordered in that same month.

A fleet of six 1200-hp *Rocket* trains built for the Rock Island has likewise standard Electro-Motive power cars weighing 220,000 lb complete or 10.9 gross hp per ton, with a 16-cylinder engine of equal performance and proportions per cylinder as those described above (62). In the three-car trains that are running between Kansas City and St. Paul-Minneapolis, 493 miles, Kansas City and Denver, 636 miles, and Fort Worth and Houston, 283 miles, the locomotive weight is 84 per cent of the trailing load of 262,300 lb, exclusive of passengers in 136 salable seats. In the four-car trains this percentage is 67. Locomotive-body framing comprises two side trusses carrying the entire load, while the stainless-steel sheathing is applied "loose" and is thus not subject to principal stresses. This construction is now standard in Electro-Motive locomotives. Outward appearance of the vehicle closely corresponds to that

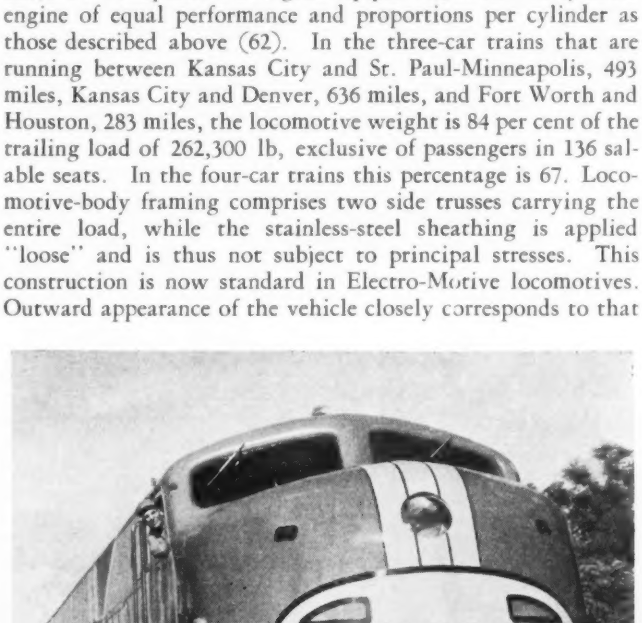


FIG. 18 THE SANTA FE *Super Chief* WITH NEW 3600-HP DIESEL-ELECTRIC LOCOMOTIVE

[1] Numbers in parentheses refer to Bibliography at end of report.

Report prepared by the Railroad Division, Committee RR6, Survey, A. Giesl-Gieslingen, chairman, and presented at the Annual Meeting, New York, N. Y., Dec. 6-10, 1937, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. For Part I, see December, 1937, pp. 931-941.

initiated by the *Green Diamond* of last year, which pattern has also been used in the Santa Fe and Baltimore & Ohio Diesels and is satisfactory with regard to aesthetics and the driver's protection in case of collision.

After development work extending over several years, the Baldwin Locomotive Works, late in 1936, completed a 660-hp switcher, illustrated in Fig. 19, bearing construction number 62000 which, after demonstration runs on various railroads, was purchased by the Santa Fe (63). It is carried on two four-wheel trucks which has become the standard arrangement in this country for switchers of similar output and weighs 212,000 lb. Power is supplied by a recently developed De La Vergne six-cylinder four-cycle engine of ample proportions, 12.5 × 15.5-in. cylinders and 600 rpm, which is characterized by a spherically shaped combustion chamber that creates beneficial turbulence. Particular attention has been paid to easy dismantling of parts.

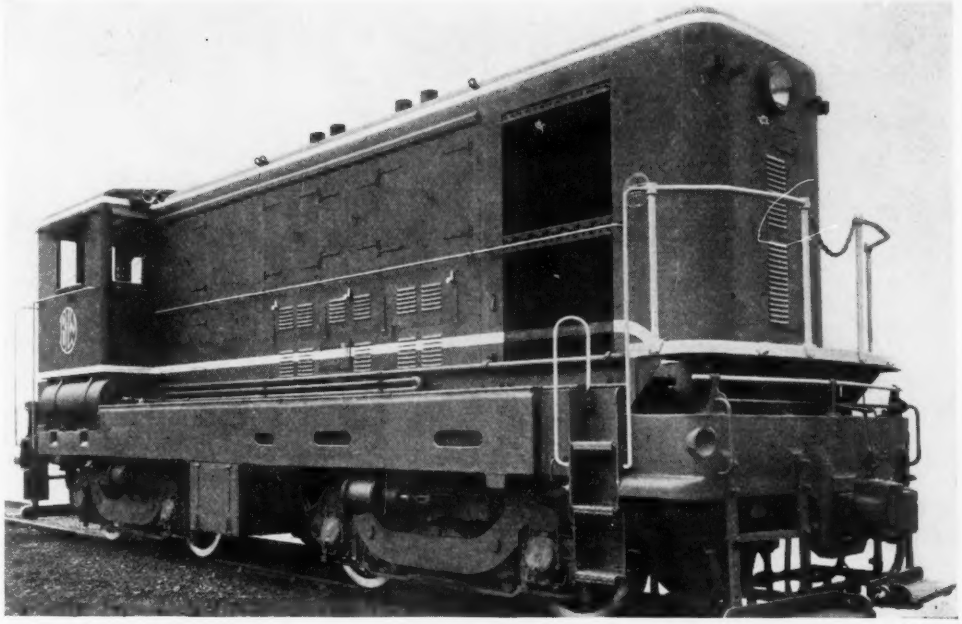


FIG. 19 BALDWIN 660-HP DIESEL-ELECTRIC SWITCHER WITH DE LA VERGNE ENGINE

The American Locomotive Company applied the Swiss Büchi system of supercharging on 900-hp transfer locomotives of the Birmingham Southern, using its standard six-cylinder, four-cycle, 600-hp Diesels, the performance of which has been boosted by the supercharger. The locomotive weighs 230,000 lb and is built according to established Alco designs (64).

Two Cummins 12-cylinder, 7 × 10-in., four-cycle Diesel engines operating at 1000 rpm, a higher speed than hitherto used in this country, have been applied to a new 1000-hp, 90-ton switching and mixed-service locomotive just delivered to the Fort Worth & Denver City, testifying to a considerable variety in engine proportions (65).

Higher-type maintenance and material required for successful operation of Diesels, as compared with steam engines, are naturally fostering the acceptance of higher mechanical standards in general. Wear figures are widely variable for Diesel equipment, and the influence of materials is yet to be more broadly determined. On the *City of San Francisco*, for instance, pistons are being replaced every 50,000 miles; this operation can be performed in 22 min. The Canadian National Railways, having 28 rail cars in operation which have already aggregated 11 million miles, report successful use of such refinements as a nitrided crankshaft which showed no wear after 371,600 miles, bearing clearances of 0.002 in. and high-lead babbitt lining of $^1/_{32}$-in. thickness on the connecting-rod big ends, and reconditioning of untreated crankshafts by hard chromium plating.

DIESEL POWER ABROAD

With few though partly notable exceptions, new Diesel power abroad has been confined to self-propelled revenue units, commonly termed rail cars, and to switching locomotives. Of the latter, many small units of 150 hp and weighing about 25 tons have become standard for secondary switching services in several countries, notably in Central Europe. A few more powerful switchers have been built in Great Britain. Orders for internal-combustion rail cars, including a diminishing number of gasoline cars, are continuing in large volume. In France their number increased from 464 to almost 600 within the year ended May 22, 1937, and with the beginning of the summer timetables on that day, scheduled French rail-car services covered 87,000 miles daily. The French Nord Railway alone increased daily mileage from 23,600 to 31,000. The German State Railways ordered fourteen 1200-hp triple and two 1350-hp quadruple streamlined trains for 100 mph, in addition to the 18 double and triple trains already in service. In most countries except Great Britain, rail-car orders are substantial, at least on a percentage basis. Large orders have been given by various South American railroads and by Egypt, and one of the principal builders, the firm of Ganz at Budapest, Hungary,

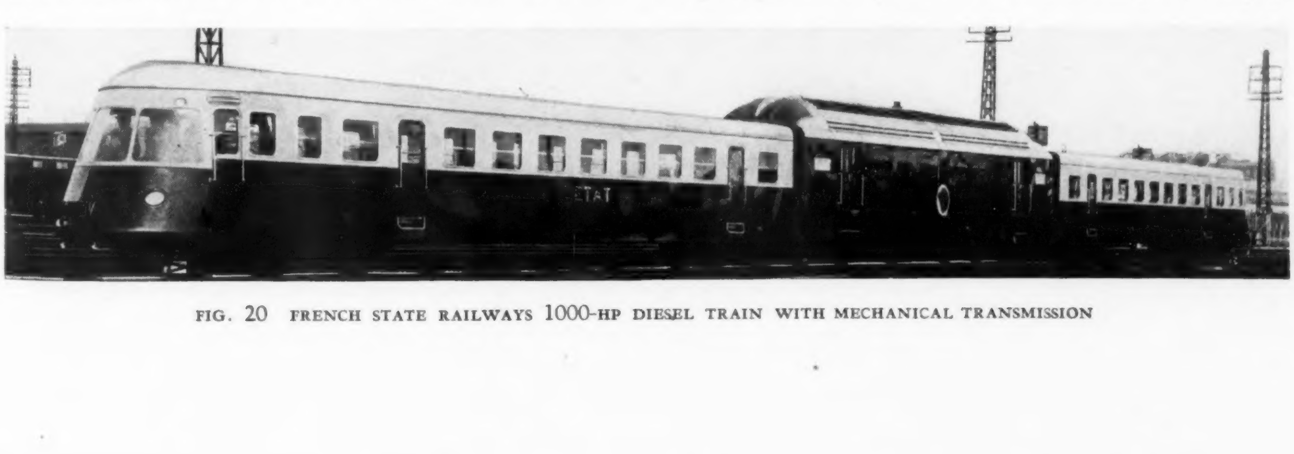


FIG. 20 FRENCH STATE RAILWAYS 1000-HP DIESEL TRAIN WITH MECHANICAL TRANSMISSION

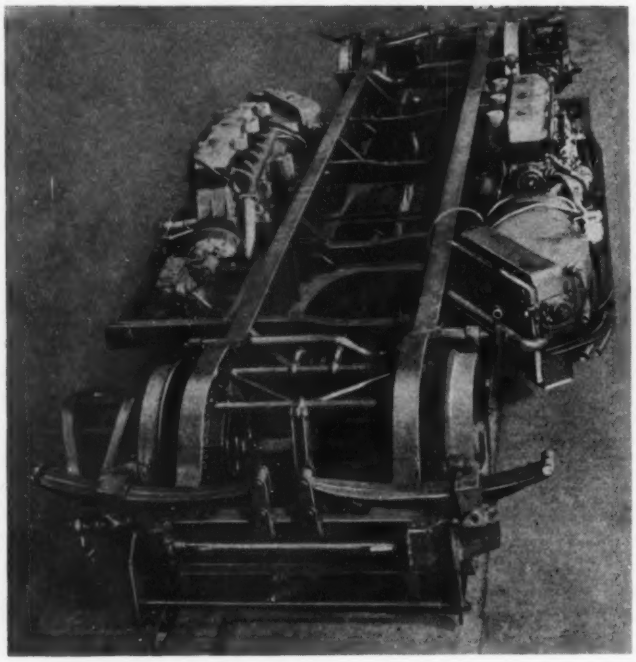


FIG. 21 OUTSIDE-HUNG MOTORS OF THE GERMAN LUBECK-BUCHENER RAILROAD'S LIGHT FOUR-WHEEL DIESEL CAR

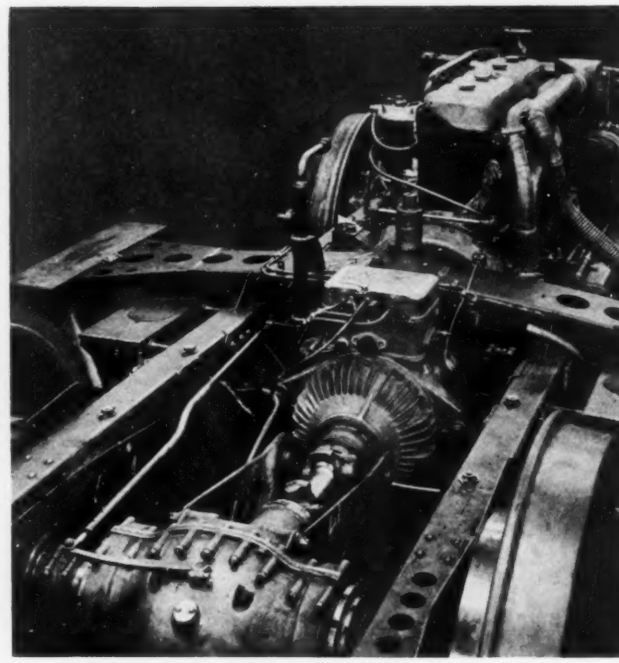


FIG. 23 AUSTRIAN FEDERAL RAILWAYS LIGHTWEIGHT DIESEL ENGINE WITH VOITH HYDRAULIC TRANSMISSION

between Jan. 1 and Aug. 12, 1937, delivered 48 rail cars or rail-car power plants and received orders for 90 more, most of them of about 300 hp.

The first of two experimental 4-6-4 double-unit 4400-hp Diesel-electric locomotives was received last summer by the Paris-Lyon-Méditerranée Railway. The service program calls for the haulage of 500-ton trains from Paris to Nice, 676 miles, at an average speed of 62.3 mph, climbing the long 0.8 per cent grades at not less than 53 mph, and encountering en route many speed restrictions due to curves, the length of which totals 112 miles, and large stations (66). It is the world's most powerful Diesel locomotive, being fitted with two super-charged 12-cylinder four-cycle Sulzer engines with two crank-shafts, each developing 2200 hp at 700 rpm, and having 12.2 × 15.4-in. cylinders. A modified Westinghouse quill drive is acting upon the 61-in. driving wheels; maximum axle load is 40,000 lb; total service weight, 498,000 lb; and Diesel-engine performance, thus 17.7 hp per ton. Each generator set weighs 67,500 lb complete with bedplate, 45,400 lb is for the Diesel engine alone or 20.7 lb per hp, and 45.5 per cent of the service weight is taken up by the locomotive frame, axles, suspension, brake equipment, and cab structure. The total coupled length is 109 ft. Strict guarantees, under penalty, have been given by the builder, including the performance of 155,000 miles in the first service year. A second locomotive of somewhat different design has been ordered.

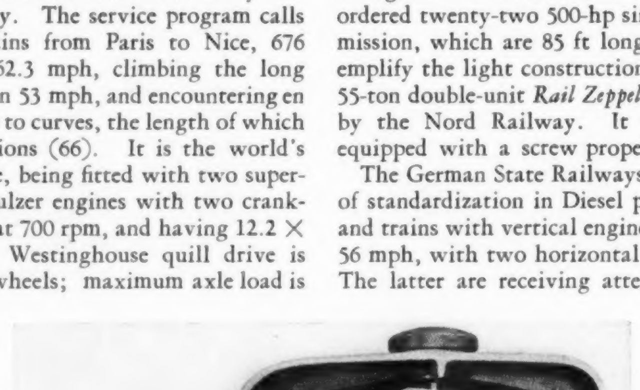


FIG. 22 COMBUSTION CHAMBER OF THE OBERHAENSLI-DIESEL ENGINE

French rail-car construction still follows widely divergent though interesting lines, recently also preferring the Diesel over the gasoline engine (67). The Renault 1000-hp triple-unit train of the French State Railways with mechanical transmission and central power car is shown in Fig. 20. The Paris Orléans-Midi and the Est systems have ordered twenty-two 500-hp single cars with mechanical transmission, which are 85 ft long, weigh only 77,000 lb, and exemplify the light construction favored in France. A 1000-hp, 55-ton double-unit *Rail Zeppelin* for 112 mph has been ordered by the Nord Railway. It will offer 90 seats and will be equipped with a screw propeller at each end.

The German State Railways have settled on a certain degree of standardization in Diesel power, involving high-speed cars and trains with vertical engines and moderate-speed cars, up to 56 mph, with two horizontal engines of 180 and 275 hp each. The latter are receiving attention in several countries (69). Thirty 360-hp cars with slower engines, operating at 900 rpm, instead of the hitherto favored 1400 rpm, are being built with a view to studying maintenance. The Lübeck-Büchener Railroad has received a light rail car with two engines hung outside of the underframe, as illustrated in Fig. 21. The car body is carried on separate springs visible at the ends. An 800-hp 4-4-4 direct-driven Diesel locomotive is again being tested by Humboldt-Deutz in Germany (71).

Gasoline engines in the 24-ton eight-wheel streamlined rail cars of the Austrian Federal Railways have been replaced by two 96-hp Oberhaensli Diesels. After con-

siderable study, these were chosen for the characteristics of their combustion chamber, which, as can be seen from Fig. 22, resembles that of the De La Vergne Diesel. Flexibility and efficiency with varying load are said to be notable. The engines operate at 1550 rpm (70) and drive through Voith turbohydraulic transmission, Fig. 23. Ten new 425-hp 50-ton class VT44 rail cars, recently ordered by the Austrian Federal Railways, have one supercharged engine with this transmission, as compared with the two-engine Diesel electrics of 1936. The Diesel engines were found so reliable that the twin-engine arrangement could be dispensed with.

Ten 0-6-0 Diesel switchers of 350 hp, with one large electric motor and rod drive, were recently received from Armstrong-Whitworth by the London, Midland & Scottish Railway.

FIG. 24 A GANZ 78-FT DIESEL RAIL CAR FOR THE ARGENTINE STATE RAILWAYS BEING UNLOADED AT BUENOS AIRES

Four new 1000-hp four-car streamlined trains were placed in service on the Danish State Railways (72). They are 270 ft long and provide seats for 222 passengers. Particulars on the earlier three-unit trains were given in an article that appeared in the early part of this year in *Railway Age* (73).

A noteworthy large-scale rail-car program is in progress on the Argentine State Railways. Early in 1937, the 34 rail cars ordered from Ganz in Hungary had been put in service, and, last spring, 38 more as well as four triple-unit trains were ordered from the same builder. Mechanical transmission is used throughout, with an efficiency of over 90 per cent at approximately the rated output (74). The single cars, Fig. 24, although destined for various uses ranging from suburban service to long-distance traffic in double units with electropneumatic control and built for three different gages, have a standardized power plant. A Ganz-Jendrassik four-cycle engine with six 6.7×9.5-in. cylinders and maximum rating of 275 hp at 1450 rpm drives 30-in. wheels on both axles of the motor truck through a standard gearbox. The truck assembly for the meter gage is shown in Fig. 25. A wheel base of nearly 12 ft is used for this gage as well as for the standard and broad, $5^1/_2$-ft, gages. Car bodies for the narrow-gage

FIG. 25 STANDARDIZED GANZ 275-HP DIESEL POWER PLANT FOR ARGENTINE STATE RAILWAY CARS

cars range from 78 to 82 ft in length and are 8 ft 2 in. in width. Both standard and broad-gage cars have the same body dimensions, 76 ft 5 in. in length and 9 ft 5 in. in width. The interior equipment has considerable variety and the specifications provided that the cars should be arranged to permit easy changes to meet traffic demands. Many cars are air-conditioned with Freon. A broad-gage car weighs about 88,000 lb complete, so that the power supply is 6.2 hp per ton gross and about 5.7 net after transmission losses. Car bodies and trucks are of chrome steel having 72,000 to 85,000 lb tensile strength and are welded throughout. Some of the broad-gage cars had to be divided at the body center, for transport, and the halves were arranged for connection by bolting and welding. The broad-gage triple-unit trains to be delivered next summer are destined for luxurious service between the Atlantic Coast and the health resort of Bariloche in the Andes Mountains, a distance of several hundred miles. The nonarticulated cars will be over 84 ft long. Each of the two six-wheel 13-ft wheel base power trucks will carry an eight-cylinder 400-hp engine with standard Ganz mechanical transmission. The four-wheel intermediate trucks have an 11-ft wheel base for smooth riding on second-grade track. Several other South American railroads have placed orders in the current year for Ganz equipment of similar characteristics, which include 10 single cars of especially light design and 85 ft long and 5 double units for the Uruguayan State Railways and 12 broad-gage articulated units for the Central Argentine Railway. The latter will have a speed of 70 mph and are remarkable for their great width which is almost 11 ft over the outside of the body and 10 ft $3^3/_4$ in. inside.

The Ganz-Jendrassik engine that propels the single rail cars of the Argentine State Railways is used on the 30-ton Metro-Vick-Cammell rail car that was built last summer for service in Great Britain and was described at that time in *The Railway Gazette* (76). It was also installed in 5 of the 40 articulated Diesel trains of The Netherlands Railways (75) which were placed in service in 1934 and achieved distinction by functioning faultlessly while the other 35 had to be modified.

The Egyptian State Railways ordered 20 Ganz Freon air-conditioned 275-hp cars this year They are similar to those ordered three years ago (77).

ELECTRIC MOTIVE POWER

Consideration of the broader aspects of railroad motive power calls for the inclusion of at least a brief summary of developments in electric traction. Furthermore, electric-vehicle design involves many mechanical problems. In the steam-turbine locomotive of the London, Midland & Scottish Railway, torque transmission to the main driving axle is accomplished by means that were originally developed for electric single axle drive, and, while the early electric locomotives suffered from indiscriminate acceptance of steam-locomotive details which were not suitable for these new requirements, ample opportunity exists for both industries to derive reciprocal benefit.

FIG. 27 PASSENGER LOCOMOTIVE FOR THE PARIS-LE MANS ELECTRIFICATION

As to major undertakings, the Pennsylvania on Jan. 27, 1937, announced the extension of its electrification to Harrisburg, Pa. Scheduled to be completed in 1938, this and several associated freight line electrifications involve 315 miles of line and 773 track miles, rounding out the program of 1928 which had been delayed by the depression. The Pennsylvania will then possess 2677 miles of electrified trackage, or 37 per cent of the total electrically operated standard railroad track in the United States, which corresponds to about 3083 route miles (78). No other electrifications are scheduled in this country. Eighteen main-line locomotives have been ordered in the first three quarters of 1937, all but one of high power.

FIG. 26 SWISS FEDERAL RAILWAYS HIGH-POWERED CLASS 118 ELECTRIC LOCOMOTIVE

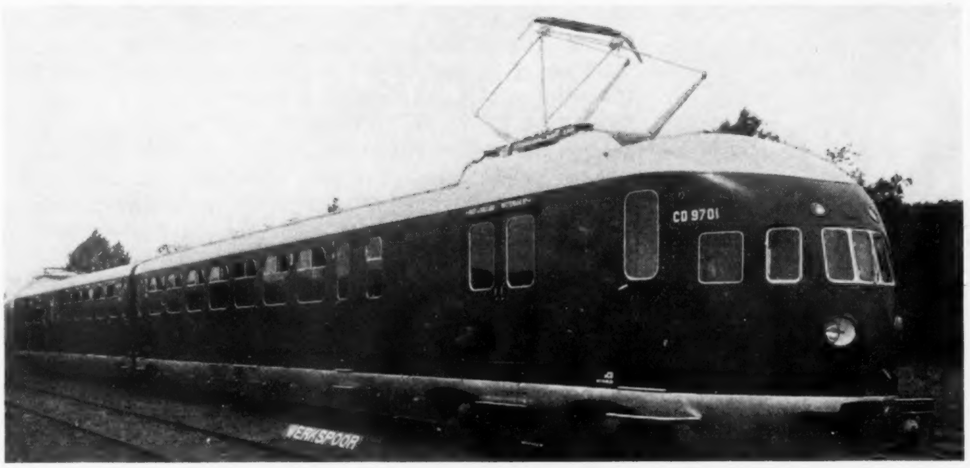


FIG. 28 ELECTRIC TRAIN FOR THE NETHERLANDS RAILWAYS

Abroad, where approximately 10,000 route miles were operated electrically in 1935, several important projects were completed or inaugurated. The French State Railways, in May, began electric traction from Paris southeast to Le Mans, 131 route miles, with 1500 volt direct current. In July, the British Southern Railway opened the 95-mile London-Portsmouth electrification, which is operated exclusively by multiple-unit cars using direct current at 660 volts. The French Paris-Orléans-Midi Railway is extending its electrification from Orleans via Bordeaux to the Spanish frontier, a distance of 432 miles, and expects to have the line in service before 1939. In Germany, the State Railways are working on the 15,000-volt, 16$^2/_3$-cycle, 218-mile, Nürnberg-Leipzig-Hälle project which will be completed in 1939. The Austrian Federal Railways are electrifying the main line between Salzburg and Linz, 78 route or 200 track miles, and will use the same current as the German project. Large projects are under way in northern Italy, spurred by lack of fuel resources, and the present 2000-mile electric network of the Italian State Railways will gradually be extended by the addition o 810 route miles.

The distinction of being the world's most powerful traction vehicle still belongs to the Swiss Federal Railways double-unit class 118 locomotives of 1932. Using the system of denomination that is customary in electric practice, namely, of expressing the number of carrying axles by figures and that of the driving axles by letters, *A* for 1, *B* for 2, and so forth with a subscript *o* for single-axle drive, this engine is of the 1-B_o-1-B_o-1 + 1-B_o-1-B_o-1 axle arrangement. It consists of two essentially equal units, coupled back to back, with a total length of 112 ft; the total weight is 545,000 lb, of which 353,000 lb or 44,300 lb per axle is on drivers. The contract performances at about 40 mph were 6420 hp continuously, or 23.6 hp per ton for locomotive No. 11801 shown in Fig. 26, and 6720 hp or 24.7 hp per ton for locomotive No. 11851 with twin-motor drive. More than 8000 hp or 30 hp per ton has been reached over limited periods.

The twin-motor quill drive, used on the recent Pennsylvania passenger locomotives, is favored in this country for high-speed operation. It will also be used on six 3600-hp streamlined locomotives for over 80 mph recently ordered by the New Haven, which will again receive the 2-${}_oC$-C_o-2 axle arrangement that proved so successful with regard to rail stresses as demonstrated by the New Haven locomotives of 1931 (79, 80) and by the Pennsylvania class GG1 (81). The latter's continuous output at 90 mph is 4620 hp or 20.1 hp per ton with a weight of 460,000 lb, but over 7000 hp or 31 hp per ton can be delivered over short periods. In these high-speed designs, the earlier tendency toward higher axle loads, 75,000 lb on the Pennsylvania's 2-C_o-2 class P5 locomotives with 72-in. drivers, has been abandoned in favor of loads around 50,000 lb with 57-in. drivers.

The greatest power concentration on record is obtained on the 1-D_o-1 high-speed class E18 locomotive of the German State Railways, which was first built in 1935 for 93 mph (82). Total weight is 241,000 lb and driving-axle load is 44,300 lb. Four quill-drive motors, acting upon 63-in. wheels, develop 3930 continuous hp at 80 mph or 32.6 hp per ton and reached the maximum of 6100 or 50 hp per ton for limited periods. A train of 442 tons was pulled at 101 mph with an engine weight of only 27.3 per cent of the trailing load.

For the Paris-Le Mans electrification, the French State Rail-

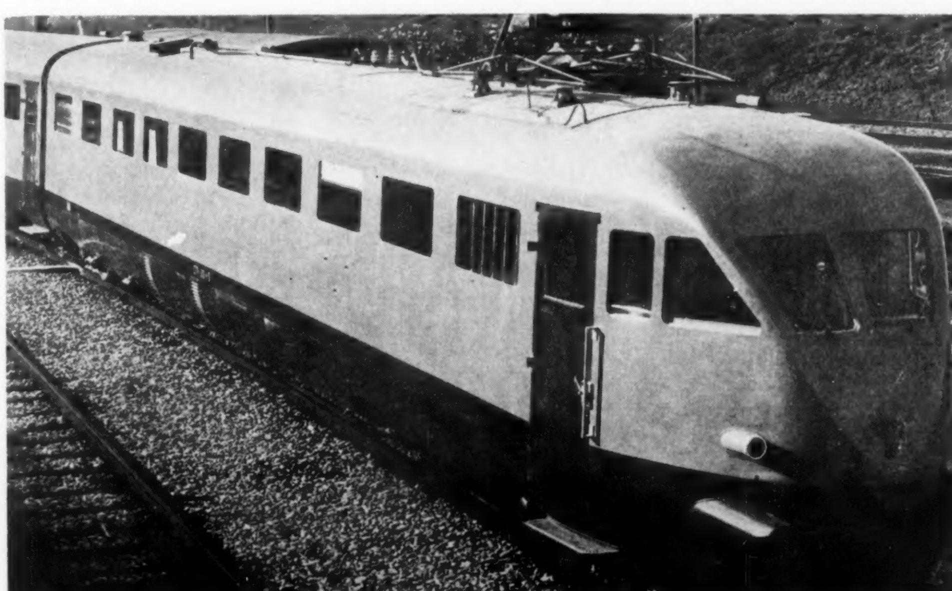


FIG. 29 ITALIAN STATE RAILWAYS ELECTRIC TRAIN DESIGNED TO OPERATE AT 112 MPH

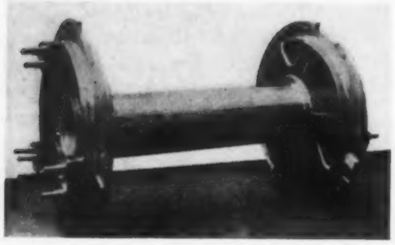


FIG. 30 THE CLASS 1170 ELECTRIC LOCOMOTIVE OF THE AUSTRIAN FEDERAL RAILWAYS IS EQUIPPED WITH AN ALL-WELDED QUILL DRIVE

FIG. 31 DRIVING DISK OF THE ALL-WELDED QUILL DRIVE USED ON THE AUSTRIAN FEDERAL RAILWAYS CLASS 1170 ELECTRIC LOCOMOTIVE

ways have put in service 2-D_o-2 locomotives of the Paris-Orléans type, which is shown in Fig. 27, developing 3250 continuous hp and weighing 287,000 lb or 22.7 hp per ton. The greatest power per ton for lightweight trains is shown by the two-unit articulated stainless-steel trains for the same line, 20 of which have been built under the Budd license. Weighing 143,000 lb empty and seating 130 persons, this train has a continuous performance of 1180 hp or 16.6 hp per ton of tare weight with a 17 per cent higher hourly performance. For all practical purposes, this is matched by the two new three-unit nonarticulated streamlined trains for 93 mph which were put in regular service on Oct. 3, 1937, by the Swiss Federal Railways. They are of 259,000 lb total weight and 225 ft long, are driven by eight motors totaling 1980 continuous hp at 75 mph or 15.3 hp per ton with a 17-per cent increase for 1 hr, and seat about 200 persons (83). To reduce unsprung masses to the minimum, nose-suspended motors have been avoided and quill drive that was especially developed for 35.5-in. wheels by the Oerlikon Works and Sécheron is used.

The Netherlands Railways are purchasing a considerable number of two- and three-car electric streamlined trains for 75 mph. These trains, which are illustrated in Fig. 28, will begin service in 1938 on the newly electrified lines.

A three-car high-speed train of the Italian State Railways which was built in 1936 for 112 mph is shown in Fig. 29. It weighs 258,000 lb and has an hourly performance of 1530 hp or 11.9 hp per ton. The interior is roomy, seats being provided for 94 persons.

The Austrian Federal Railways have ordered eight 1-D_o-1 streamlined passenger locomotives for 81 mph. Krauss trucks combining the carrying axle with the adjacent driving one will be used at each end. Based upon favorable experiences obtained with welded construction in earlier locomotives, the main and truck frames will be completely welded. The Elin Company at Graz, Austria, had long specialized in welding locomotive parts and, for instance, even in the hollow quill-drive shafts used on the 2250-hp B_o-B_o class 1170 locomotives, cast-steel construction has been abandoned in favor of the design illustrated in Figs. 30 and 31, where the shaft is made of rolled, electrically welded steel plate, with all parts of the driving disks welded thereto.

OTHER PRIME MOVERS

Fig. 32 shows two gasoline-mechanical streamlined cars of the American Car and Foundry Company's standard type with a horizontal six-cylinder engine which were delivered in April to the Chicago & Eastern Illinois. These are the only rail cars built thus far in 1937 for domestic service. Maximum speed is 65 mph; service weight, 62,500 lb; and rated performance, 200 hp. Alloy steel and aluminum have been used in construction of the car body and the cast-steel trucks have a short wheel base of 6 ft (84).

The 99-ft Micheline car experimentally built last year for the French State Railways has been successful and a number of duplicates were added. In general, however, the gasoline drive is losing against the Diesel, and numerous conversions from gasoline drive have been made on many railroads abroad.

Special steam-car developments mentioned in last year's report have not yet materialized. German tests with automatic solid-fuel firing are being pushed. The Besler steam train on the New Haven has been successful in general, but damage to the superheater as a result of oil deposits has made removal of oil from exhaust steam the most important requirement. This calls to mind the elaborate filtering arrangements found necessary for the Russian condensing locomotives previously mentioned.

PASSENGER-TRAIN CARS

Domestic orders in the first three quarters of the year numbered 471, of which two thirds actually have passenger accommodations while the remainder are revenue cars of various descriptions suitable for running in passenger trains, including also 80 milk cars. This is 54 per cent above the total for all of 1936, but orders were concentrated in the first five months. The largest single order was for 50 more of the New Haven's well-known modern coaches. Canadian railways ordered 90 cars. Abroad, the largest programs are again carried out by the British and German railways. The former ordered 2000 cars for 1937, the latter several hundred. The relatively largest number of new cars, namely, 500 for suburban service, are being installed by the Belgian National Railways.

Weight of air-conditioned passenger cars in this country shows a tendency to stabilize around 100,000 lb. In some

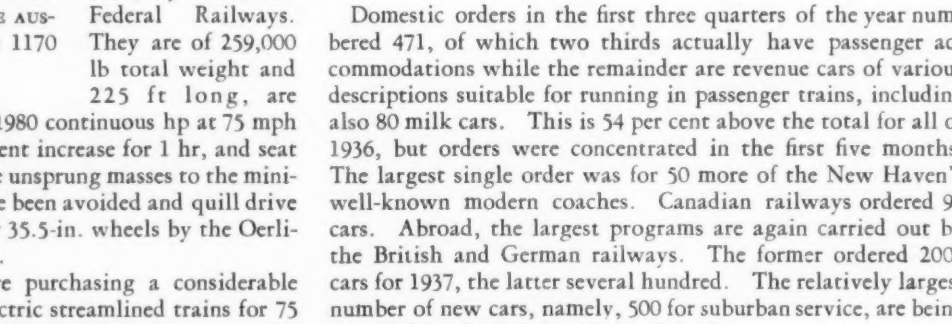


FIG. 32 CHICAGO & EASTERN ILLINOIS GASOLINE RAIL CAR

cases, limits of lightweight construction have apparently already been reached, at least for designs thus far used. This is demonstrated by the Santa Fe's experimental stainless-steel car No. 3070, mentioned in last year's report (85). While the weight of this car was only 83,530 lb or 1050 lb per linear ft for length over buffers of 79 ft 8 in., the nine new cars for the *Super Chief* weigh 1190 lb per ft. A stiffer car-body structure has been employed in the new cars that were delivered last May by the Edward G. Budd Manufacturing Co., and return has been made to the modified Pratt truss construction for the side frames (86), in place of the rectangular framing used in car No. 3070. Average car weight is 94,500 lb and the length of most cars is 79 ft 10 in. Body weight, exclusive of trucks, is about 820 lb per linear ft with all equipment, interior width is 9 ft $3^1/_8$ in., and total height above the rail is 13 ft 6 in.

A stainless-steel sleeping car named *Forward* of substantially similar construction (87) had been built by the Pullman Company at the end of 1936. Length over end sills is 81 ft 6 in. and the weight is 110,700 lb with triple-bolster trucks that probably weigh about 40,000 lb, leaving approximately 870 lb per ft for the body. As in the Budd-type cars, truss framing carries the entire load with "loosely" applied sheeting. Favorable specific weights have been attained with this construction. An accurate comparison of car weights is difficult for obvious reasons, but mention certainly should be made that the weight of the Milwaukee's *Hiawatha* cars of 1936 is only 1125 lb per ft and only 770 lb per ft for the body, although using Cor-Ten instead of stainless-steel sheeting. *Hiawatha* cars, like European lightweight designs employ tubular construction, where framing and sheeting act in unison. They are 9 ft $6^3/_4$ in. wide inside, with an outside height of 13 ft 1 in.

New cars for the Union Pacific's *Challenger*, Fig. 33, measure 81 ft over couplers and have aluminum bodies, with a body weight of 70,584 lb or 870 lb per ft. Triple-bolster trucks of the Union Pacific-Pullman standard type weigh 39,916 lb or 55 per cent of the body, which is a rather high percentage.

While no other aluminum cars have been built, stainless-steel

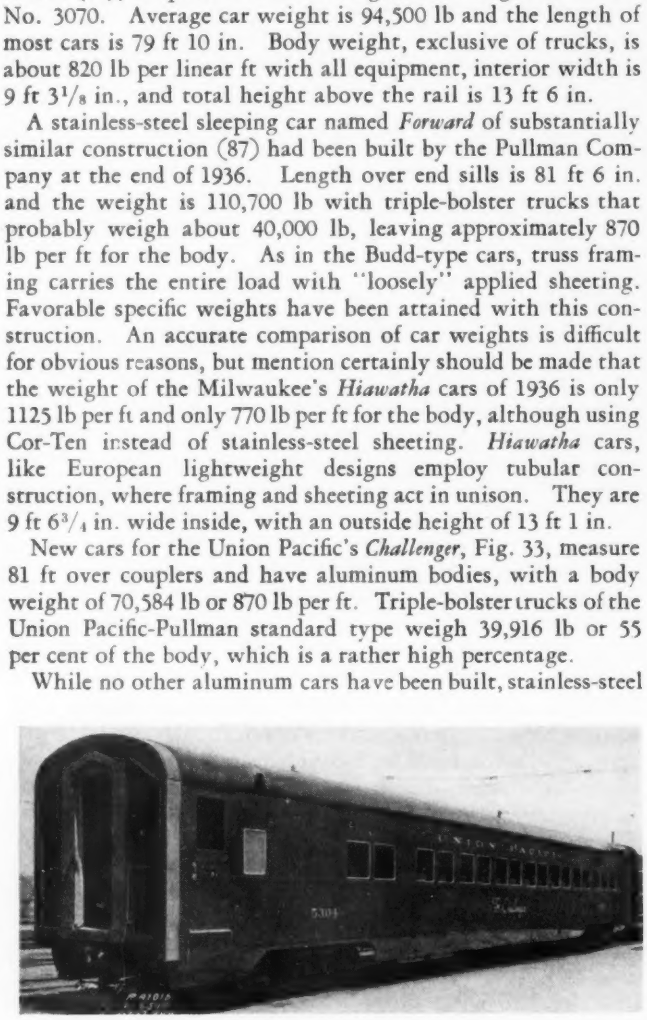


FIG. 33 PULLMAN-BUILT ALUMINUM COACH FOR THE UNION PACIFIC'S *Challenger*

FIG. 34 MODERN MAIN-LINE COACH OF FRENCH NORD RAILWAY

FIG. 35 VIEW THROUGH THE CORRIDOR OF THE ALLOY-STEEL CARS BUILT IN 1937 BY THE FRENCH STATE RAILWAYS

sheathed equipment with Cor-Ten frames received much favor, as further indicated by the two 12-car trains for the Southern Pacific's *Daylight* service (88) and two 8-car trains for the same road's *Sunbeam* between Houston and Dallas, Tex. Average car weight is 95,000 lb for the former and 98,300 lb for the latter, with partial articulation, and a weight per linear foot of from 1300 to 1350 lb. These trains also run on triple-bolster trucks. *Rocket* trains for the Rock Island have been built according to the Budd process (89). Rapid destruction of exterior paint by abrasion on high-speed trains operating in semiarid regions is a problem that stainless steel avoids.

Considerable activity is being exerted in modernizing interiors of existing equipment. In the first half of 1937, the New York Central, for example, redecorated 103 cars (90) and the Pennsylvania a similar number. The experimental roomette car appeared in Pullman service, containing 18 single rooms on both sides of a central corridor (91).

In Europe, the currently built main-line cars of the French Nord and State Railways are typical of modern practice, as far as body design is concerned. Fig. 34 shows an example of the former, measuring 73 ft 6 in. in length, weighing about 94,000 lb, built of ordinary carbon steel, and welded. Fig. 35 gives a view through the corridor of the 1937 type of alloy-steel car that was developed by the French State Railways in collaboration with the Entreprises Industrielles Charentaises. The cars are fitted with streamline diaphragms and measure 76 ft 5 in. over buffers, 9 ft $2^3/_4$ in. between side walls, and 13 ft total height. Rolled, welded framing and partly welded partly riveted tubular sheeting of steel having 93,000-lb tensile strength is used for the entire car body. Eight compartments seat 48 passengers in first or second class. The forced-ventilation system is equipped for ice cooling in summer. Total weight is smaller than for any standard European long-distance car,

FIG. 36 DINING CAR OF THE MITROPA COMPANY WHICH IS STANDARD IN CENTRAL EUROPE

FIG. 37 BELGIAN NATIONAL RAILWAYS SUBURBAN-TYPE CAR

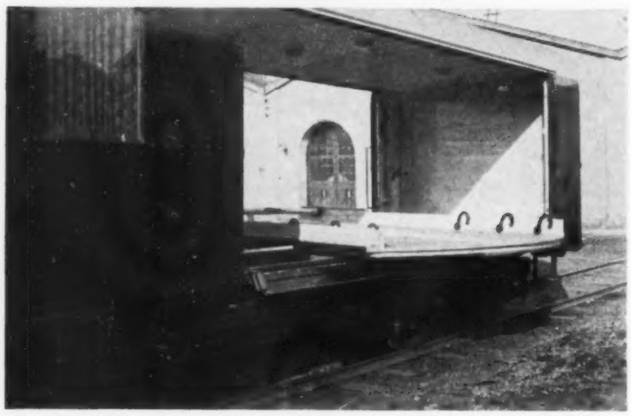


FIG. 38 PASSENGER AUTOMOBILE-TRANSPORT CAR OF THE HUNGARIAN STATE RAILWAYS

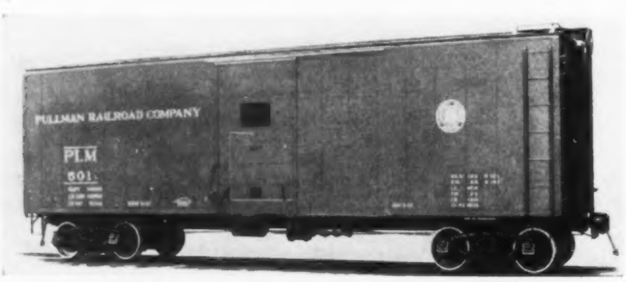


FIG. 39 50-TON ALL-WELDED ALLOY-STEEL BOXCAR BUILT BY THE PULLMAN-STANDARD CAR MANUFACTURING COMPANY

78,000 lb or 1060 lb per lin ft. Cast-stee', nonalloy, American-type equalizer trucks with SKF bearings weigh 28,500 lb which is 57 per cent of the body weight (92). Since these are too heavy to satisfy modern requirements, the central research department of the French Railways has designed a new type of truck resembling in principle the American freight-car type with light pressed side frames and improved spring suspension, two of which are expected to weigh about 21,000 lb, although the wheels have been enlarged from 35.5 to 40.6 in. The first car is about to be tested (93).

The standard dining car of the Mitropa, the German sleeping and dining-car company operating in several central European countries, which is shown in Fig. 36, is equipped with modern 12-ft wheel base trucks that are now standard on the German State Railways. Body and trucks are we'ded throughout. This car seats 44 persons and is 77 ft 1 in. long over buffers, the total service weight being 112,500 lb. Sleeping cars of equal dimensions and similar exterior weigh 117,500 lb. The yearly mileage per car operated by the Mitropa Company in 1936 was 148,000, and the patronage per sleeping car was 3530, which figures closely correspond to the 1936 averages for United States Pullman service of 154,000 and 3200, respectively.

One of the 500 Belgian cars for local service is illustrated in Fig. 37. Large doors with auxiliary air operation are provided for quick exchange of passengers. Over-all length is 74 ft 6 in., and the weight is 93,000 lb.

The London, Midland & Scottish Railway received new ten-car trains for excursion service. These are composed of five double articulated units, 563 ft in length, 8 ft 11 in. in outside width, and weighing 545,000 lb. Seats for 529 passengers, almost all third class, are provided. Welded trucks of 9 ft wheel base have particularly long, 5-ft, axle-box springs and average 13,500 lb in weight each.

An eight-car tourist train that was designed particularly for winter-sport traffic and has elaborate facilities, including a complete bathing car with six bathrooms and showers, was exhibited at Paris by the Polish State Railways.

The Hungarian State Railways are testing a car that is equipped with a turntable for convenient transportation of automobiles in passenger trains, as shown in Fig. 38. The end of the car can be opened to form a ramp for entering and leaving.

FREIGHT CARS

With 47,800 freight cars ordered for domestic service in the first three quarters of the current year, the sharp revival in freight-car buying that began in 1936 has been matched, and extraordinary activity was displayed in the early months. No definite figures have been obtained from abroad, but the markets are active and car shortages developed during August in Germany, Czechoslovakia, and Austria.

The Association of American Railroads Committee on Car Construction presented a preliminary report last June (94) on tests with the 50-ton lightweight alloy-steel boxcars that were built in 1935 by the Mt. Vernon and Pullman-Standard Car Manufacturing Companies and weighed 11.0 and 9.9 lb per cu ft of capacity, respectively. The former car, No. 9000, corresponds to the Association of American Railroads 1932 riveted design (95) but is built of Cor-Ten steel of reduced sections, while the latter, No. 500, is of special design (96) but is built of the same material and is welded throughout. Car No. 9000, weighing 36,400 lb, was found to possess sufficient merit from the viewpoint of construction to warrant favorable consideration, with some strengthening in the body bolster and center plate being recommended. More extensive changes and reinforcements as well as improvements in welding technique were found to be required in car No. 500, weighing 34,200 lb, before consideration would be warranted. Meanwhile, Pullman-Standard built No. 501, the redesigned all-welded 50-ton boxcar of 3713 cu ft or 10 per cent larger volume. This car, which is illustrated in Fig. 39, weighs 35,300 lb or 9.5 lb per cu ft and 40 per cent of this weight or 14,200 lb is in the trucks (97). Considerable development work in welding, which is finding decided favor, is being done by the Milwaukee and the Delaware & Hudson, and general indications are that boxcars of this size can be satisfactorily built of low-alloy steel with a deadweight-to-pay-load ratio of less than 36 per

cent. Recently, the economics of lightweight construction were extensively discussed (98, 99).

The experience of the Baltimore & Ohio with its 1935 "covered-wagon" type of boxcar body where the side sheets are extended and curved to form the roof also was favorable (100). This general design has been used in a reconstruction program that involved 1300 cars and was carried out between December, 1936, and last June. At present, 2000 new cars are being built according to this design (101).

Hopper cars of Cor-Ten steel are considerably in demand. Extremely light designs that were demonstrated in 1934 have been somewhat strengthened in later orders. Nevertheless, recent 50-ton cars built by the Pressed Steel Car Company, Inc. for the Pittsburgh & Lake Erie weigh only 1800 lb more than the original sample car for the Bessemer & Lake Erie (102). The capacity of 2328 cu ft has been retained so that the weight of the new cars is 13.6 lb per cu ft or 31.8 per cent of the pay load.

European freight-car construction did not produce anything of particular interest. Progress in lightweight designs as made in this country has not been matched abroad, but extensive use of welding should be noted, and the arrangements of semi-elliptic springs as generally used in Europe result in favorable vertical motion and in small unsprung weights.

MISCELLANEOUS MATTERS

A decided majority of railroad men in this country are of the opinion that roller bearings have proved to be the most important single factor in increasing the mileage and availability of railroad equipment. While roller-bearing applications made less progress abroad, their use on specific high-speed equipment is also predominant there. These developments have stimulated efforts to improve plain-bearing performance. The Magnus lubricator pad, shown in Fig. 40, is an improved adaptation of European practice in supplying oil to the journal by capillary action. This bearing is used on all cars and tenders of the new Southern Pacific streamlined trains. Resilient members hold the firmly sewed pad against the journal with a predetermined pressure. Fig. 41 illustrates the Disc-Flo arrangement developed by the National Bearing Metals Corp. (103) and in test service since June, 1936. The disk, driven from the axle by torsion springs, circulates an abundant amount of oil, part of which is wiped off by a metal spoon at the highest point, from whence it flows to the bearing by gravity. The pressure lubricator for journal bearings that is shown in Fig. 42 was developed by Friedmann in Austria, originator of the Nathan force-feed lubricator, and uses a disk rotating in a wedge-shaped ring space. Oil pressure is built up at the highest point, and practically the entire quantity of oil lifted by the disk is pumped through the journal. Apart from the cooling effect, agitation of the oil, which recent research has found to be detrimental (104), is effectively suppressed. The Austrian Federal Railways report freedom from bearing trouble on their fast 2-8-4 and 4-6-4 type locomotives as a result of using this system on all axles, including drivers for which it has also been developed, with resultant increase in availability (105).

Demand for improved riding qualities of railroad equipment is increasing. As reported last year, Switzerland is continuing considerable activity along novel lines (106) but there, as elsewhere, evolution is too rapid to perm t a report on definite trends. From extensive service observation, the best fully developed trucks, considering smooth riding at high speeds and in curves, simplicity, ease of inspection and maintenance, and low weight for long wheel base, would appear to be the all-welded trucks used on the Austrian 104,000-lb class VT42 Diesel

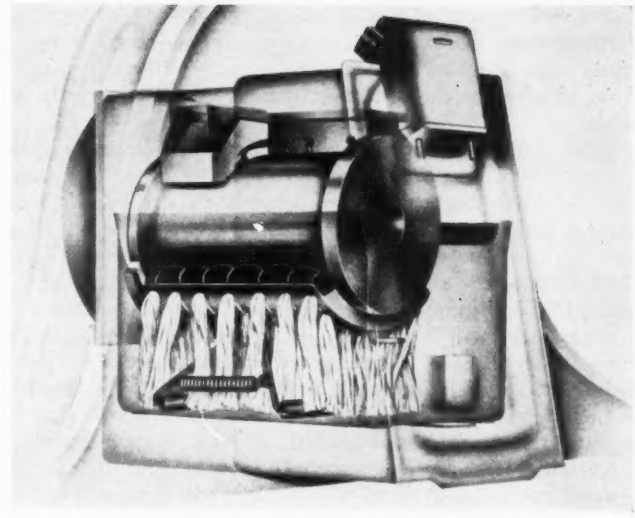


FIG. 40 MAGNUS METAL CORPORATION LUBRICATOR PAD AND BEARING

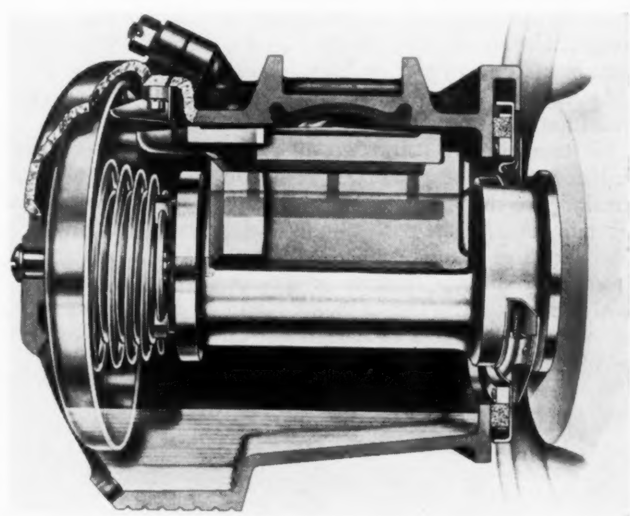


FIG. 41 NATIONAL BEARING METALS CORP. "DISC-FLO" JOURNAL BEARING

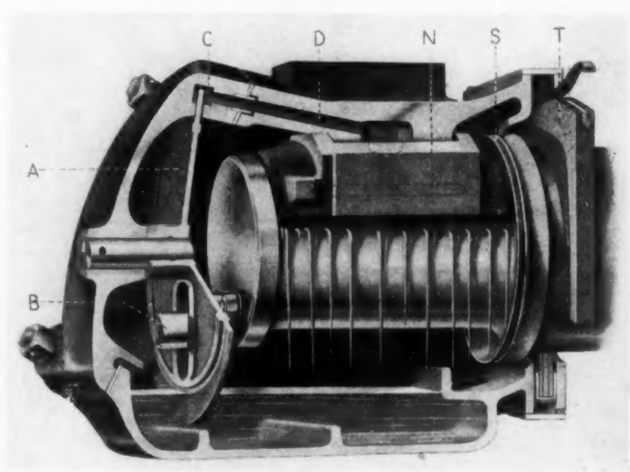


FIG. 42 AUSTRIAN FRIEDMANN-TYPE PRESSURE LUBRICATOR FOR JOURNAL BEARINGS

cars with longitudinal outside bolster springs and incorporating further refinements over the German trucks on high-speed equipment. Use of wheel threads of cylindrical or slightly tapered form in place of the former 1:20 taper is now definitely established.

Braking equipment as used on high-speed trains in the United States is well advanced over that in other countries, particularly in matters of speed-dependent control and simultaneous action on all cars which latter requirement has been met by the development of electropneumatic operation. Tests carried out on the streamliner *City of San Francisco* with the so-called HSC high-speed brake, developed by the New York and Westinghouse Air Brake Companies, have recently been described in detail (107) and testify to the high state of development reached. The test rack shown in Fig. 43 is descriptive of the volume of research involved. Much additional work is in progress on such items as brakeshoes, rigging, supplementary drum and disk brakes, materials, and similar items. In Europe no new light has been thrown on the question of separate versus wheel-rim brakes, but the drum brake is losing ground to the disk type on specific high-speed equipment, while no such brakes are used on standard main-line cars.

A tight-lock coupler meeting the requirements of the Association of American Railroads has been developed by the concerted efforts of the manufacturers (108) and 700 of these were in use or on order on May 10, 1937.

A cumulative study of resistance data for lightweight trains has been presented by A. I. Totten (109).

Air conditioning had been applied to 9311 domestic cars on June 30, 1937, of which 4751 belong to the railroads and the remainder to the Pullman Company. Abroad, applications are becoming more nume ous and now include some standard cars. Two extensive reports on the subject by the Association of American Railroads Equipment Research Division have recently been issued. The Canadian National Railways are testing new developments in refrigerator-car heating and cooling in collaboration with the National Research Council (110).

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87 *Railway Age*, Jan. 9, 1937, p. 108.
88 *Railway Age*, March 13, 1937, p. 418.
89 *Railway Age*, Aug. 28, 1937, p. 256.
90 *Railway Age*, Sept. 18, 1937, p. 375.
91 *Railway Mechanical Engineer*, May, 1937, p. 215.
92 *Revue Générale des Chemins de Fer*, June, 1937, p. 331.
93 *Revue Générale des Chemins de Fer*, February, 1937, p. 117.
94 *Railway Age*, June, 22, 1937, p. 1040D71.
95 *Railway Mechanical Engineer*, July, 1935, p. 326.
96 *Railway Age*, June 22, 1935, p. 959.
97 *Railway Age*, June 12, 1937, p. 969.
98 *Railway Age*, June 5, 1937, p. 944.
99 *Railway Age*, Sept. 4, 1937, p. 305.
100 *Railway Age*, April 27, 1935, p. 646.
101 *Baltimore & Ohio Magazine*, August, 1937, p. 19.
102 *Railway Mechanical Engineer*, January, 1935, p. 11.
103 *Railway Age*, Jan. 30, 1937, p. 229.
104 *Kraftfahrtechnische Forschungs-Arbeiten des Vereines deutscher Ingenieure*, No. 7, 1937 (pamphlet).
105 *Monthly Bulletin of the International Railway Congress Association*, 1936.
106 *Schweizer Archiv für angewandte Wissenschaft und Technik*, April, 1937, p. 81.
107 *Railway Mechanical Engineer*, April, 1937, p. 153.
108 *Railway Age*, June 23, 1937, p. 138.
109 Trans. A.S.M.E., May, 1937, p. 329.
110 *Ice and Refrigeration Illustrated*, September, 1937, p. 911.

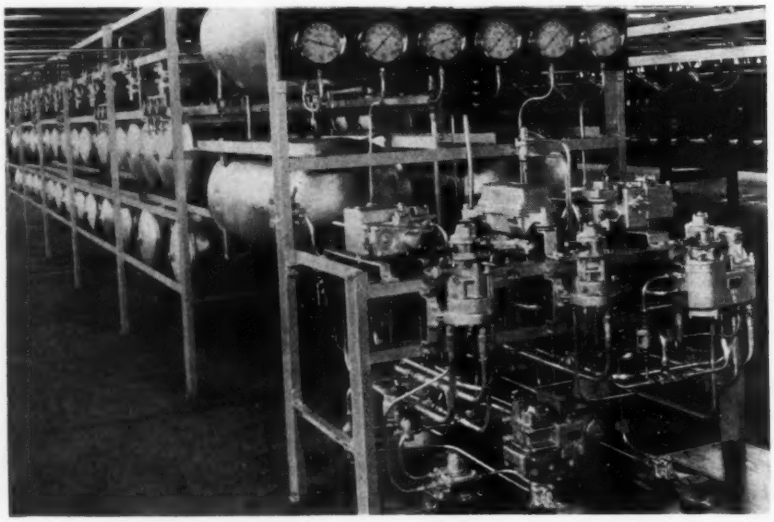

FIG. 43 FOURTEEN-CAR TEST RACK FOR "HSC" HIGH-SPEED TRAIN BRAKE OF THE NEW YORK AIR BRAKE CO.

WATER-COOLED UNDERFEED STOKERS

Operating Results and Recent Installations

By J. S. BENNETT

AMERICAN ENGINEERING COMPANY, PHILADELPHIA, PA.

At THE Annual Meeting in 1935, a paper[1] was presented describing the design and development of water-cooled underfeed stokers. In the present paper, performances of this stoker in commercial operation are reported, certain practical problems that have arisen are discussed, and the methods employed to correct these conditions are described. The water-cooled stoker is not, strictly speaking, a stoker which is cooled by water but consists of a furnace that is water-cooled at top and bottom and on all four sides, with the fuel-feeding and distributing mechanism introduced below and outside of the furnace.

NORTHERN ILLINOIS COAL EFFECTS MARKED ECONOMIES

For the last three years, practically the entire load at the plant of the Iowa Electric Light and Power Company at Cedar Rapids, Iowa, has been carried on eight water-cooled Taylor stokers. Seven of these are of the dump-type, designed in 1920 and later converted to the water-cooled type, while the eighth is of the rotary ash-discharge type. The first water-cooled dump-type stoker went into service in May, 1934, and the crusher stoker, in May, 1935.

Substantial economies were effected by the ability of the plant to burn a northern Illinois strip-mine coal with the typical characteristics given in Table 1, using preheated air at temperatures from 325 to 425 F.

From May, 1935, to Aug. 24, 1937, the seven rebuilt dump-type stokers have burned 305,423 tons of coal with a maintenance cost, including material and labor, of 2.85 cents per ton. The completely new crusher-type stoker has burned 47,660 tons with a maintenance cost including labor and material, of 1.26 cents per ton. These figures included certain items that could properly be charged to development.

Experience obtained while burning 353,083 tons of this strip-mine coal in a single plant indicated the desirability of certain changes. As a result of the low ash-fusing temperature, molten ash ran under the bottom pushers, Fig. 1, and had a tendency to make the pushers bind. This was corrected by providing self-cleaning pushers and increased cooling of the plates under them, thereby chilling the ash more effectively.

TABLE 1 TYPICAL CHARACTERISTICS OF NORTHERN ILLINOIS STRIP-MINE COAL

Moisture, per cent	16.0
Volatile matter, per cent	37.0
Fixed carbon, per cent	37.0
Ash, per cent	10.0
Sulphur, separately determined, per cent	3.17
Btu per lb, as fired	10436
Fusing temperature of ash, F	1900

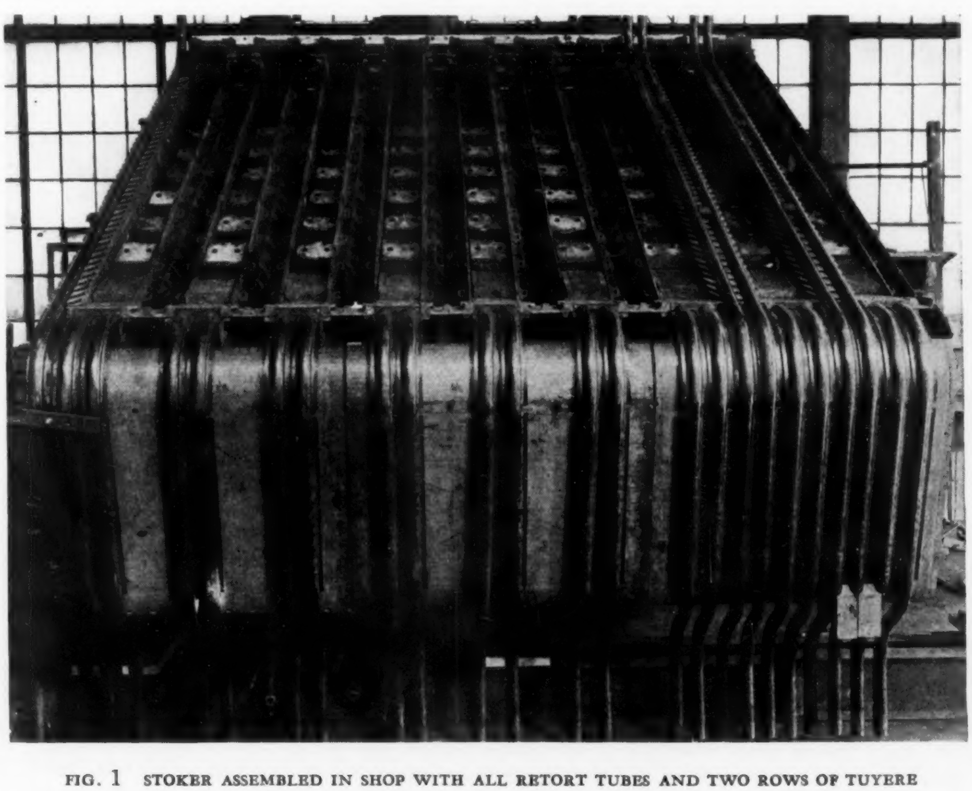

FIG. 1 STOKER ASSEMBLED IN SHOP WITH ALL RETORT TUBES AND TWO ROWS OF TUYERE TUBES IN POSITION

Contributed by the Fuels Division for presentation at the Annual Meeting, New York, N. Y., Dec. 6–10, 1937, of The American Society of Mechanical Engineers.

[1] "Design and Development of Water-Cooled Underfeed Stoker," by J. S. Bennett and C. J. Herbeck, Mechanical Engineering, December, 1935, pp. 761–765.

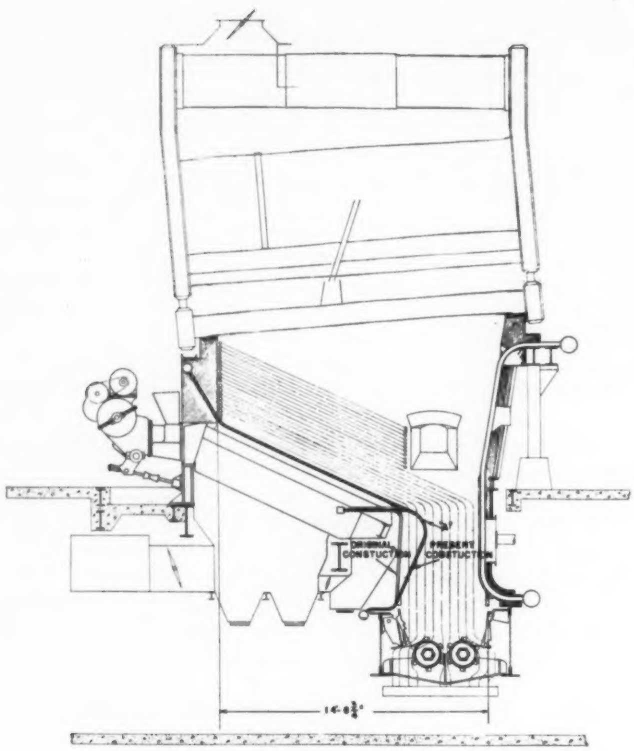

FIG. 2 MODIFIED ASH PIT IMPROVED OPERATION AND MATERIALLY REDUCED COMBUSTIBLE IN ASH

It was found desirable to increase the overfeed section of the crusher-type stoker as shown at *A*, Fig. 2. This resulted in a material reduction of combustible in the refuse and produced smaller and more friable ash. Uniform ash pits were secured by the steeply undercut wall obtained by increasing the overfeed section and by redistribution of the teeth on the rolls, Fig. 3, thereby producing extra ash-feeding effect at points where the flow tended to be sluggish. These changes, as well as the Noblo, or air-distributing tuy`re, were incorporated in the installations discussed later in this paper.

PROBABLE LIFE OF STOKER COOLING TUBES IS 33 YEARS

Frequent inspections and measurements by calipers disclosed practically no abrasion of the stoker cooling tubes. A section of one stoker cooling tube was removed in August, 1937, after having been in service over three years. As nearly as can be determined, the outside diameter has been reduced 0.011 in. On this basis, the heavy-gage stoker tubes provided could be in service 33 years before being worn to the point where the metal thickness would be less than that required by the pressure.

Heat absorbed by the stoker-protective tubes was determined by measuring the temperature of the cold water entering and the quantity and temperature of the water leaving the tubes. Results obtained are given in Fig. 4, and heat absorbed is expressed in British thermal units per square foot of projected area of the tubes only. This does not conform to the usual method of expressing heat absorption in waterwalls, where space between the tubes is included in determining the total projected area. Using cold water for testing gave higher heat-transfer rates than would be obtained in regular operation. It is probable that changes in coals and varying fuel-bed conditions would affect the results materially. While results of these tests influenced future design, in actual practice a considerable margin of safety is allowed.

Forced circulation using $1^1/_2$-in. O.D. tubes was employed on the first eight stokers, because the waterwalls already installed employed this system. The new unit, just installed, is cooled by 3-in. O.D. tubes and employs natural circulation. This topping unit, which is arranged as shown in Fig. 5, is built for 675-lb per sq in. working pressure and employs natural circulation. An extension of the bridge-wall surface cools the rear of the ashpit. The front of the ashpit and the 14-retort stoker are cooled by tubes that run continuously from a header at the base of the ashpit through the stoker to a header in the front wall, thence under the front arch, and over the combustion space to the rear or return header of the cross-drum straight-tube boiler. These return tubes are, in effect, the lowest row of tubes of the boiler surface and are staggered to form a slag screen.

NATURAL CIRCULATION INTRODUCES MANY PROBLEMS IN DESIGN

Natural circulation for stoker cooling tubes introduces many new problems in stoker and waterwall design. The arrangement of the cooling system must be such that it can be combined with a wide variety of boilers and furnaces. Factors that usually apply to any waterwalls, such as first cost, accessibility, ease of cleaning, appearance, and the like, required con-

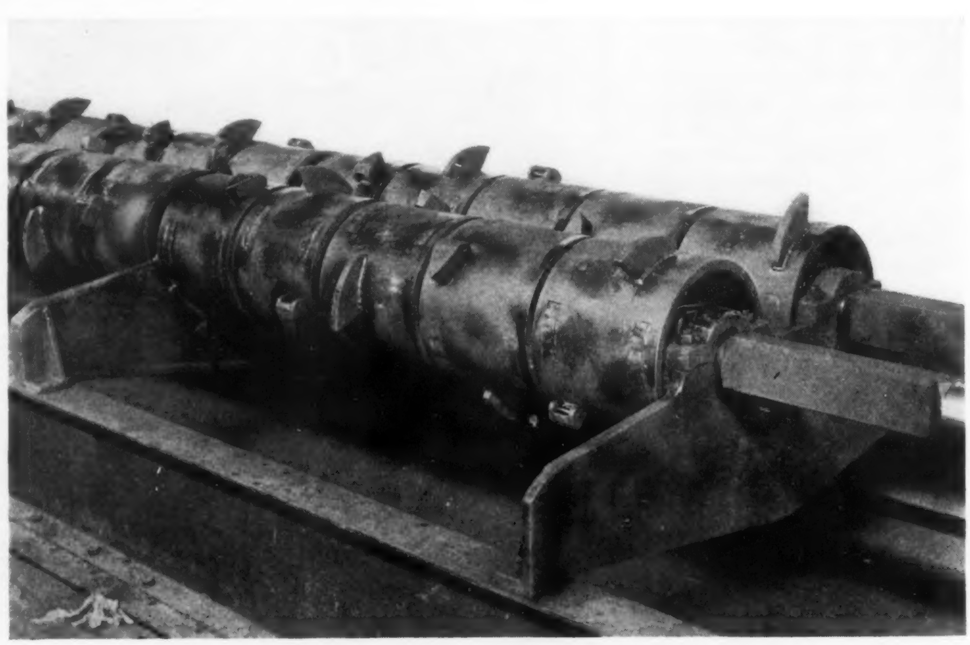

FIG. 3 UNIFORM GRINDING IS MAINTAINED BY WELDING EXTRA LARGE TEETH TO STEEL SHELL AT CERTAIN POINTS TO ASSIST THE REGULAR TEETH

sideration, and new circulation conditions had to be determined by laboratory research and checked by field tests. In one case, a major change of the circulation system in the field was deemed desirable to insure satisfactory performance. Extensive exploration of stokertube temperatures in service has shown that metal temperatures do not materially exceed those of the saturated steam, indicating effective cooling that should insure long tube life.

Natural circulation is also employed in the 200,000-lb-per-hr bent-tube unit, using 675 lb per sq in. and 825 F, at the mine-mouth plant of the Pennsylvania Electric Company at Seward, Pa. Low-price coal made first cost an important item, so no front-wall cooling was provided except that obtained by carrying the tuyère tubes over the lower portion of the wall.

FOUR-STOKER INSTALLATION BURNING OHIO COAL

Since 1930, a plant in the Ohio coal district has generated steam with underfeed stokers burning Logan County, W. Va., coal and using preheated air at 375 F. To secure additional steam, a water-cooled stoker unit was installed which was capable of burning Ohio coal with the typical characteristics that are given in Table 2 and using preheated air at 375 F.

TABLE 2 TYPICAL CHARACTERISTICS OF OHIO COAL

Moisture, per cent	2.25
Volatile matter, per cent	38.48
Fixed carbon, per cent	48.40
Ash, per cent	10.87
Sulphur, separately determined, per cent	4.01
Btu per lb, as fired	13000
Fusing temperature of ash, F	2130

Here, the tuyère tubes provide protection for the lower portion of the front wall, while the upper portion is cooled by a separate wall with tubes spaced on $4^1/_4$-in. centers. Water

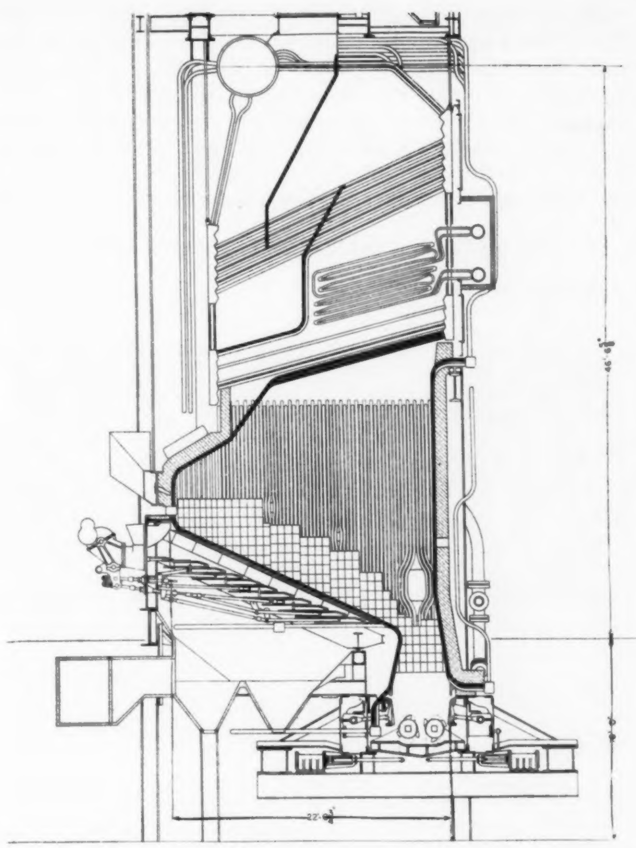

FIG. 5 SECTION THROUGH BOILER IN A MID-WEST ELECTRIC LIGHT AND POWER PLANT WHICH IS FIRED BY A 14-RETORT STOKER

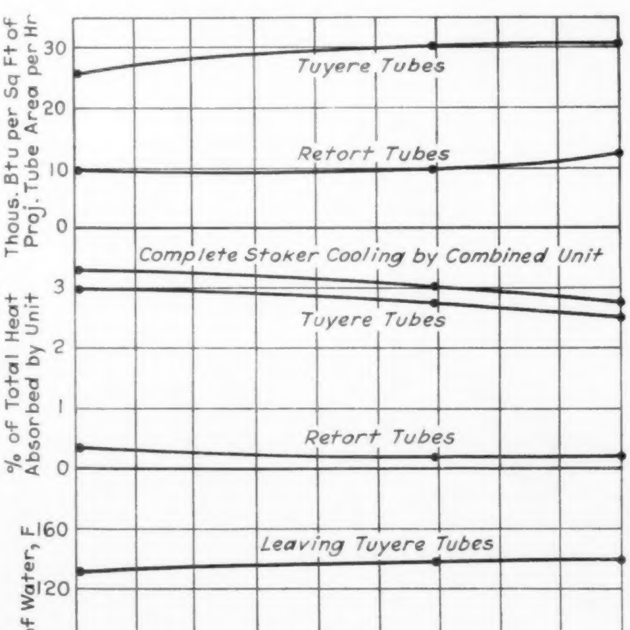

FIG. 4 RESULTS OF HEAT-ABSORPTION TEST

passing through the stoker retort tubes to the header in the wind box supplies a number of tubes in each side wall. The retort tubes passing under the bottom pushers are sloped slightly, thus improving circulation at this point. To permit effective use of Ohio coal in the entire plant, a decision was made to convert the three existing stokers into water-cooled units. Retort-tube circulation was provided by bringing the risers from a header running through the wind box under the stoker up the front wall and thence into the front boiler drum. Circulation is simple and direct and water-wall protection for the brickwork, where erosion might be anticipated, is provided.

Dump-type stokers have been used extensively for small boilers so thought should logically be directed to applying water cooling to this type. In an installation at the Sloane-Blabon Corporation, Philadelphia, Pa., Fig. 6, a continuous-discharge stoker is installed under a bent-tube boiler. Tubes from both the tuyères and the retorts run up the front wall of the stoker and enter a header at the top of the front wall. Design of this installation was influenced by space limitations and the opportunity for burning inexpensive coals with preheated air.

LONG CONTINUOUS BOILER LOADS IN CHEMICAL PLANTS

Where conditions permit, the simplest circulation system should be employed. Typical examples of this procedure are the four-retort stokers at McGill University, Montreal, Canada. In this installation, the tuyère tubes and the risers from the retort-tube header in the wind box are carried directly up the front wall of the furnace to the boiler drum.

Chemical plants provide one instance where continuous

boiler loadings for long periods are required. The Pittsburgh Plate Glass Company, Columbia Chemical Division, at Barberton, Ohio, has been a pioneer in developing fuel-burning equipment to utilize efficiently the variety of low-price coals available in that area. Economic advantages of high steam pressure dictated the installation of a unit operating at 900 lb per sq in. with a final steam temperature of 750 F. Necessity for maintaining sustained high ratings with minimum boiler outage, when burning Ohio coal with preheated air, led to the application of water cooling and metered air control to the stoker. The new unit is designed for a continuous rate of 55 lb per sq ft when burning coal with the typical analysis given in Table 3.

TABLE 3 TYPICAL ANALYSIS OF LOW-PRICE OHIO COALS

Moisture, per cent	5.3
Volatile matter, per cent	37.0
Fixed carbon, per cent	46.0
Ash, per cent	11.7
Sulphur, per cent	4.02
Btu per lb, as fired	12730
Fusing temperature of ash, F	2100

Oil or natural gas can be burned in furnaces that are fired by water-cooled stokers. A typical furnace of this type is a nine-retort unit under an 80,000-lb-per-hr 360-lb per sq in. boiler at Rochester, Minn. This installation has gas burners in the rear wall. Changing from gas to coal firing and back to gas firing without loss of steam pressure has been found possible by the simple expedient of reducing or increasing the coal-burning rate as the quantity of gas used is varied. At the time this was written, no attempt had been made to reduce the coal-burning rate to less than that required to generate 10 per cent of the total steam. The slow coal feed prevents spontaneous combustion in the bunkers when gas is burned, and the incandescent fuel bed is available at all times to pick up the load, almost instantaneously, when the gas supply is cut off unexpectedly. This system has been found especially effective for burning "dump gas" available for short periods each day.

Where gas is employed at frequent intervals, the burners are cooled by bleeding a small quantity of air through them. When coal only is burned for long periods, refractory screens are inserted. The burners are placed in hinged frames so that they can be swung out of the way to permit quick removal of the refractory plugs, if desired.

The CO_2 in the flue gases from one unit, when 90 per cent natural gas and 10 per cent coal is burned, is slightly higher than the CO_2 obtained from a furnace in the same plant designed for gas only.

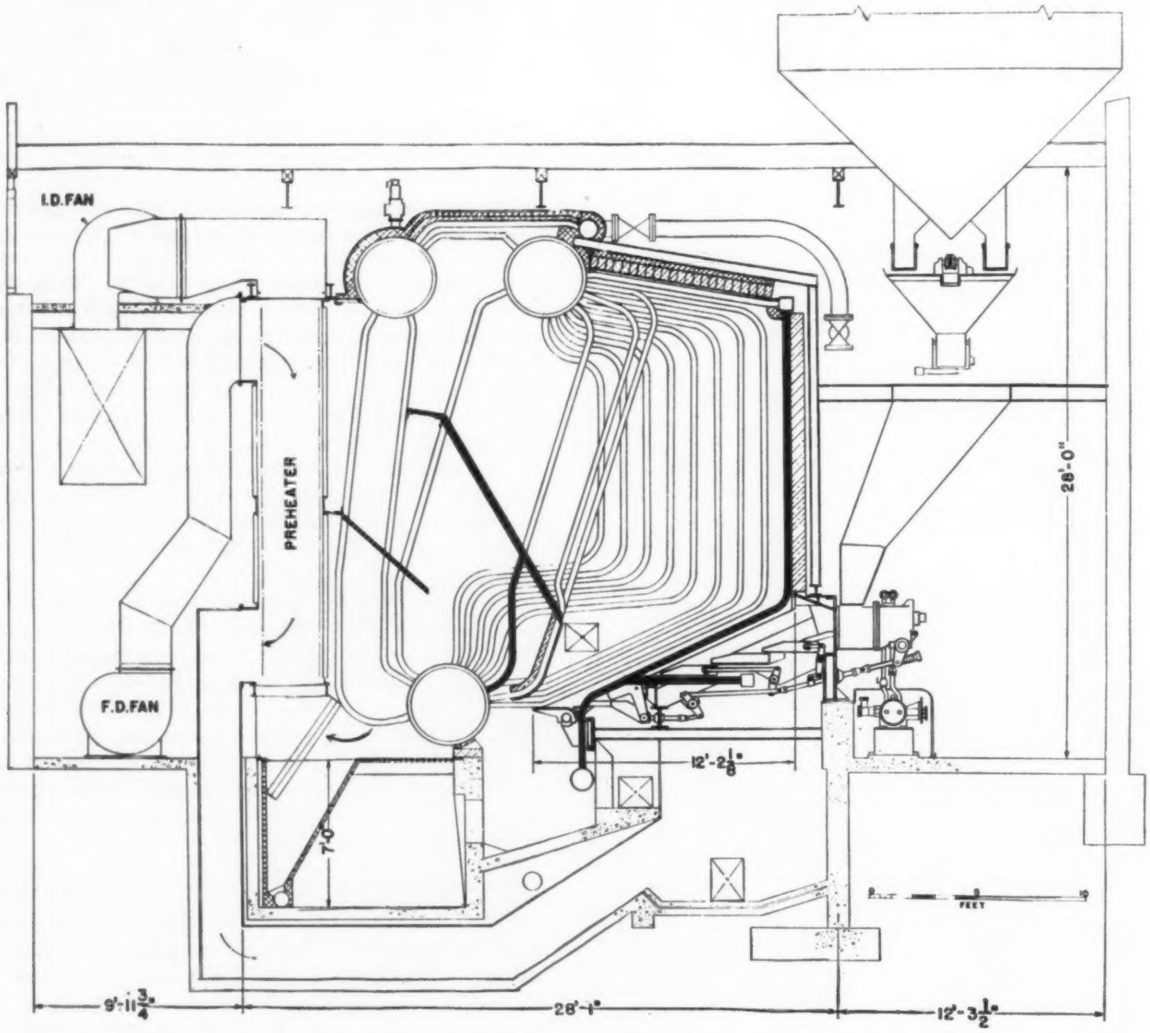

FIG. 6 SECTION THROUGH A BENT-TUBE BOILER INSTALLED IN A FLOOR-COVERING PLANT AT PHILADELPHIA AND FIRED BY TWO FOUR-RETORT STOKERS OF THE CONTINUOUS-DISCHARGE TYPE

Development in
WELDING LARGE STRUCTURES

By C. C. BRINTON

WESTINGHOUSE ELECTRIC & MFG. CO., EAST PITTSBURGH, PA.

TODAY with our greatly increased production, many advantages of fabricating machine parts from rolled steel that is flame-cut to the required shape and welded together to form any desired shape become more apparent. Without attempting to arrive at an exact comparison of the investment involved in the equipment required to produce parts of castings instead of fabricated rolled steel, it can be readily seen that flame-cutting and welding machines are much cheaper than furnaces and molding equipment. Also, just as important, the time required for expansion of production facilities is considerably less. When production is involved, time lost in replacing and repairing castings is as much a factor as the cost savings to be found in fabricated construction. Where it was not uncommon to lose time because of scrapping or repairing from 5 to 15 per cent of cast parts, this is now unknown if the part is fabricated. Using rolled steel, we can be assured that the material is free from sand, blowholes, and other imperfections and is uniform in quality with constant physical properties.

When using castings, carrying a wide variety in stock was necessary and this represented a considerable inventory investment compared to stocking a limited variety of standard shapes and plates of the required sizes to take care of the demand. Time required to secure special sizes of plates which are only needed for special machine parts is still less than that required to make up patterns. Developments that improve design or manufacturing methods are now carried out without delay, as no patterns must be changed or remade and no castings scrapped or used up, for we are using a basic material.

CHANGING FROM CASTINGS TO WELDING PRESENTS PROBLEMS

When first changing many of our structures from cast iron or steel to rolled-steel plates and shapes welded together to form approximately the same structure, it was extremely difficult not to produce the identical shapes that made up the individual castings. Although foundry limitations were well-known, manufacturing and economical limitations for fabrication and welding procedure were not generally recognized, with the result that some structures were produced which were not economical or practical for the fabrication. Considerable progress has been made since that time in recognizing that the problem is not solved by balancing the cost of steel plate at 2 cents per lb against a rough casting at 6 cents. Cast iron ready to pour and steel plates and shapes ready to be burned and formed to shape should be considered as the raw material in each case and the final cost of each type of structure to be manufactured built up from there.

Available shapes produced by the steel mills are basically structural and were designed for building bridges, buildings,

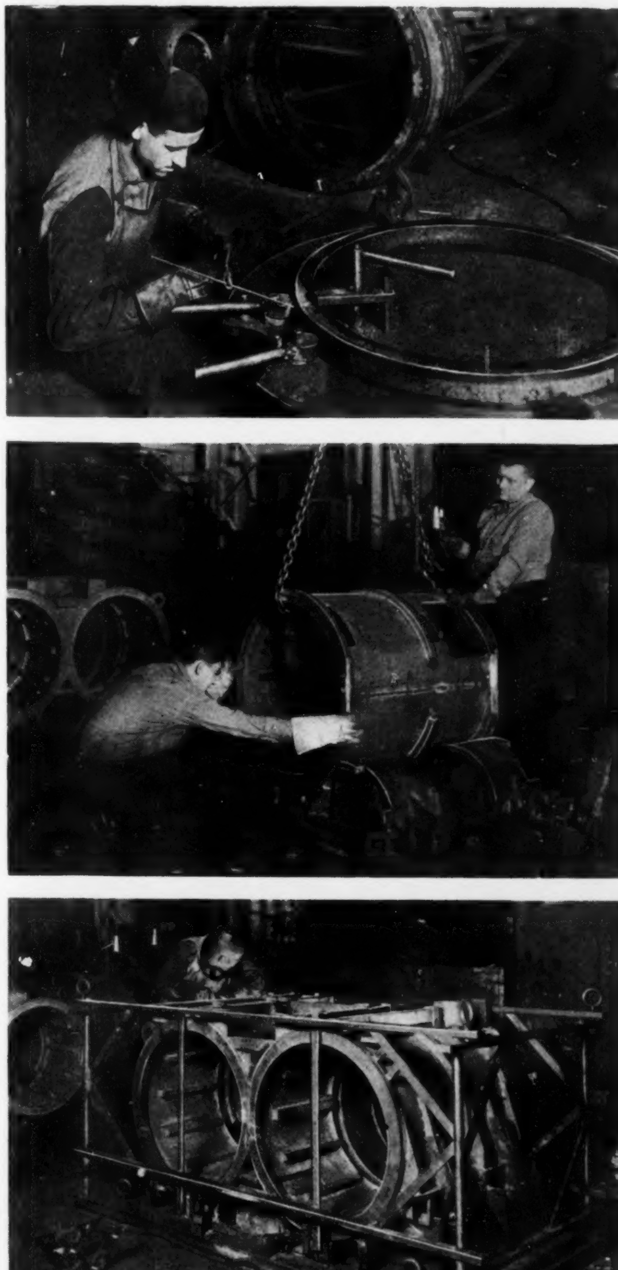

FIG. 1 THREE EXAMPLES OF USE OF SIMPLE ASSEMBLY FIXTURES
(Top, welding rings to definite size; middle, placing motor frames in a locating fixture preparatory to welding; bottom, tack-welding motor-frame parts.)

Contributed by the Machine Shop Practice Division and presented at a meeting, Atlantic City, N. J., Oct. 19, 1937, held under the joint auspices of the Machine Shop Practice Division of The American Society of Mechanical Engineers and the American Welding Society.

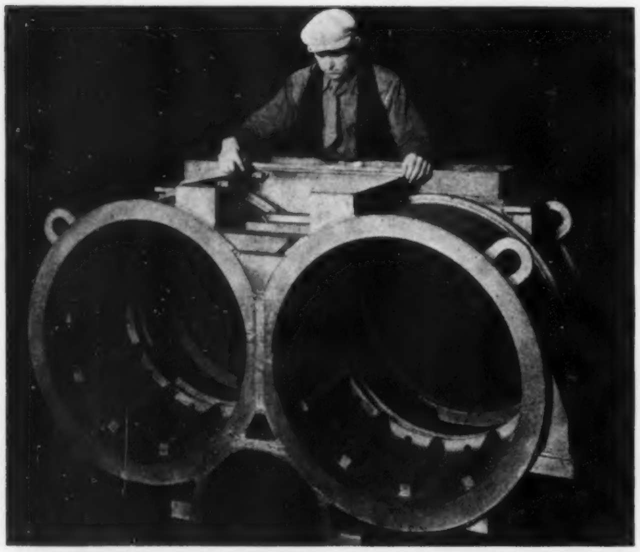

FIG. 2 FRAME INSPECTION AFTER WELDING AND STRESS RELIEVING

FIG. 5 ROTATING AND TILTING FIXTURE FOR FRAME SECTION

FIG. 3 FRAME SECTION READY FOR WELDING MOUNTED ON AUTOMATIC WELDING MACHINE

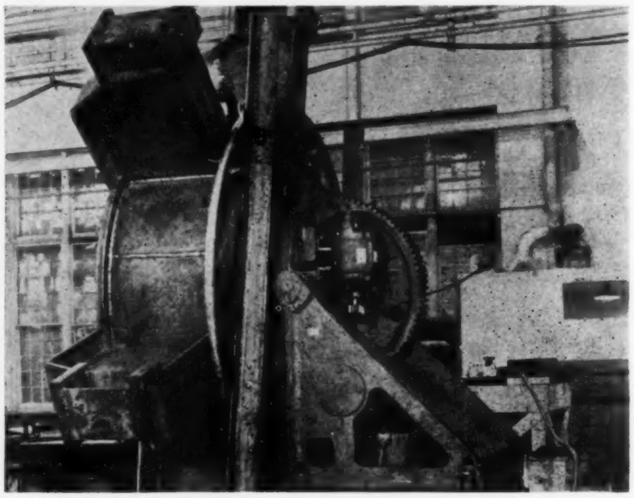

FIG. 6 LOWER THRUST-BEARING BRACKET FOR WATER-WHEEL GENERATOR MOUNTED ON MANIPULATOR

FIG. 4 WELDING OPERATION ON CENTER SECTION OF LARGE UPPER BRACKET FOR WATER-WHEEL GENERATOR

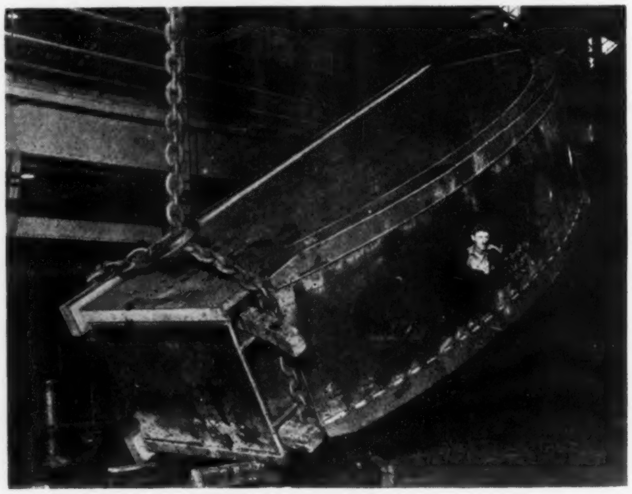

FIG. 7 POSITIONING HEAVY PRESS BED FOR WELDING BY MAKING USE OF OVERHEAD CRANES

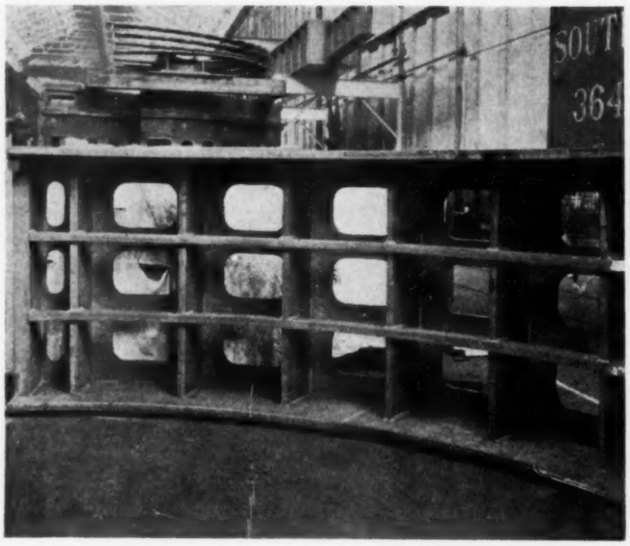

FIG. 8 VIEW FROM INSIDE OF VERTICAL-GENERATOR FRAME

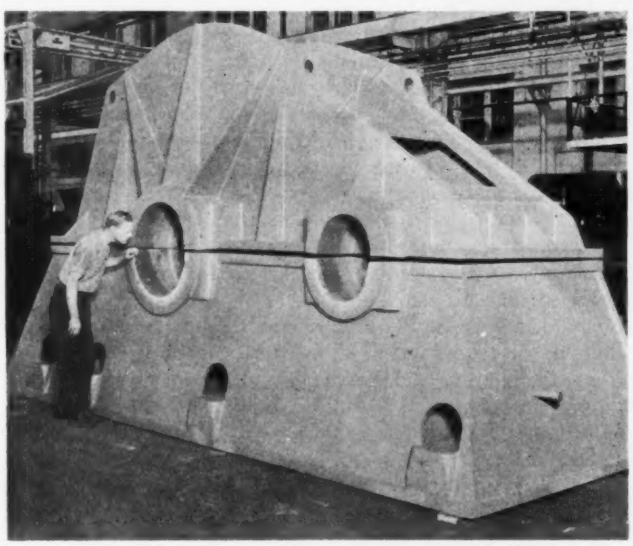

FIG. 9 WELDED REDUCTION-GEAR HOUSING

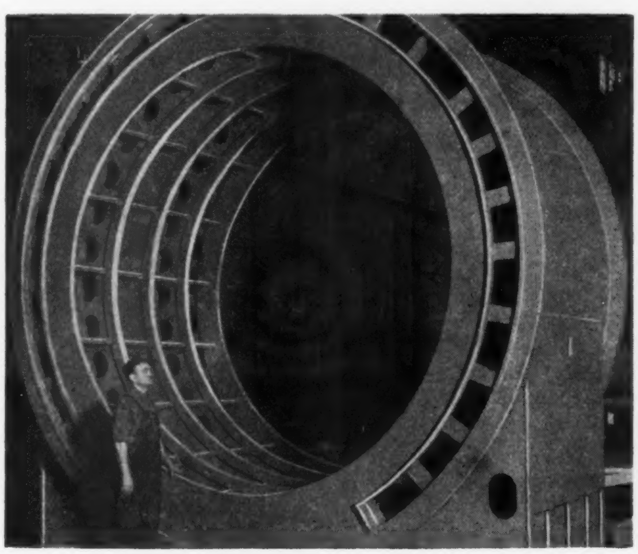

FIG. 10 FRAME FOR HYDROGEN-COOLED FREQUENCY CHANGER

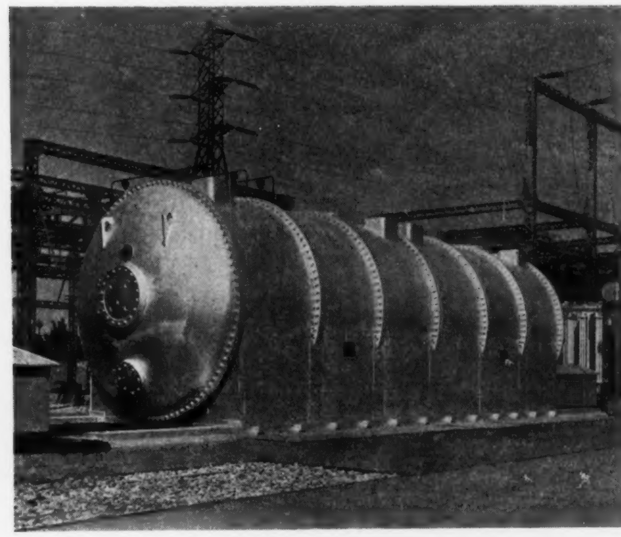

FIG. 11 FREQUENCY CHANGER INSTALLED OUTDOORS

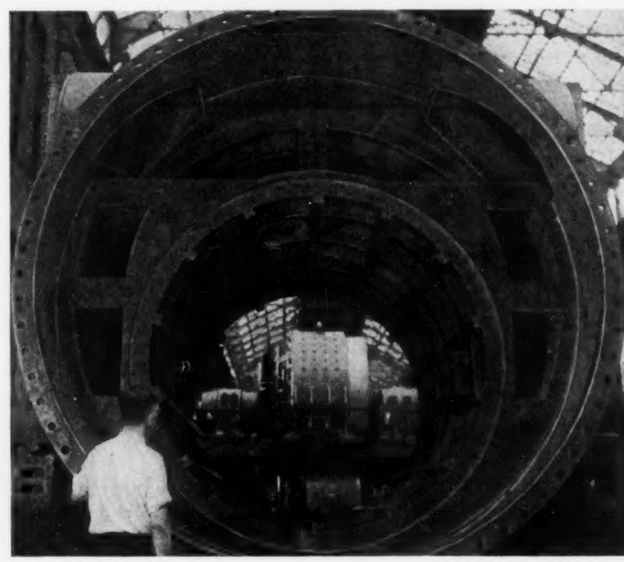

FIG. 12 FRAME FOR TURBINE-DRIVEN GENERATOR

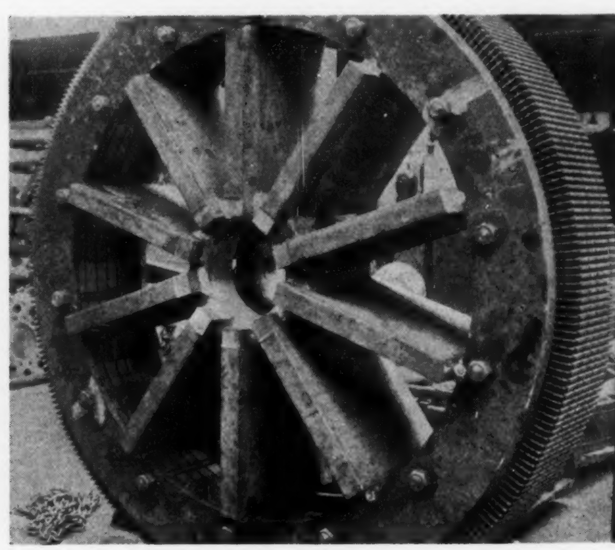

FIG. 13 LARGE WELDED DIRECT-CURRENT ARMATURE ROTOR

and the like, but, with careful selection of those suitable for machine parts and their application in the proper place in the part, many economical structures are now produced with a low scrap ratio. Plates, however, are made commercially in a wide variety of sizes and thicknesses which can be cut and shaped to almost any desired form to serve any application and used with the standard shapes when desirable in fabricating nearly all machine parts. The only limitation so far has been the size of the plates produced on the largest plate mills.

For some heavy sections, it is desirable to use semifinished material such as slabs, billets, or blooms. Although these are primarily intended for rerolling and, consequently, tolerances are larger than on finished materials, they are suitable for parts that must be machined or where larger tolerances are no handicap. For certain parts of these structures, using steel castings welded to the structure is economical in many cases, when the sections are of such shape that making the entire part of plates and shapes is difficult economically. Although no definite rule can be established to cover such cases, an example is the use of heavy cylindrical castings as bushings in large gear cases.

WELDING IS UNECONOMICAL UNLESS SCRAP IS USED UP

The problem of arriving at the cost of any structure is not always clear cut unless definite application is made of the scrap pieces left when the parts are cut or the structure is charged with the rough-size plates and shapes and only credited with the scrap value of the leftovers. With a reasonable activity, we have been able to establish a standard ratio to use for such material as follows: Plates, 160 per cent; slabs, 110 per cent; and angles, bearings, channels, and similar shapes, 110 per cent. Results of the application of these ratios for a typical month of 1937 are shown in Table 1.

TABLE 1 SCRAP RATIOS FOR DIFFERENT CLASSES OF MATERIAL

	Weight, lb			Ratio,
	Received	Consumed	Scrap	per cent
Plate	1,565,000	1,002,000	563,000	156
Slabs and bars	356,022	317,572	38,450	112
Shapes	236,489	226,509	9,980	104
Total	2,157,511	1,546,081	611,430	140

To keep the scrap within or less than the ratio, stock sizes must be chosen to suit those of the largest activity that are needed for the particular parts used and special sizes ordered for large parts or those that require a large number of a size not carried in stock for a particular order. Unfortunately, not enough small pieces are required for our type of fabricated structure to allow the greater part of the scrap to be used, and close supervision is required to apply unused portions of plates to this activity economically. Supervision is most important when the drawings are made, since scrap ratio is generally determined by design of the parts and choice of plate sizes from which they are cut. Also, in some cases, some of the scrap pieces can be applied to other parts of the structure if a careful layout is made of the cut-out pieces. The burden of carrying a great many irregularly shaped pieces for an indefinite time in the manufacturing department for possible application is generally too great, and these must be scrapped at regular intervals or they will be used up inefficiently.

PROBLEMS INVOLVED IN ASSEMBLING WELDED PARTS

The problem of assembling the parts in minimum time and with sufficient accuracy so that excessive weld material will not be needed can only be solved by cutting and forming pieces to exact size and shape with weld preparation carefully done. Pieces that leave large gaps between parts or require extra cutting by hand during assembly cause more lost time and extra welding than any other condition met in fabrication. To avoid this condition, careful layout before burning, using sheet-steel templates where enough pieces of the same shape are required, is done for parts too large for automatic cutting machines. Layouts are prick-punched at a few places so that cutting can be checked easily as it progresses. In many cases, the part can be cut out of large plates without cutting through the outside boundaries, and thus avoid some of the distortion from the cutting torches. For smaller pieces, cutting machines using paper templates or steel where the magnetic method is used will produce satisfactory parts, and, in many cases, several parts of the same shape are produced at the same time with two or more cutting torches.

To arrange the work most economically, burning, grinding, and trimming have been grouped so that all this activity is segregated from the assembly and divided into certain classes so that a group always does the same class of work. In like manner, the assembly before welding is divided into several classes so that each group handles only one class of work. When assembling and tacking the large parts for final welding, steel surface plates are used which are sufficiently accurate to keep the structure level and allow the parts to be aligned properly. Enough tack welding is applied to hold the structure in shape and, in most cases, to move it to another location for final welding. Welding procedure is not the same with all structures but varies to suit the problem and usually is arrived at from experience on similar parts with a certain amount of cut and try and checking during the actual welding.

Since one of the main elements in cost saving is reducing the time required for machining and eliminating some machining operations, fixtures must be used for holding parts in place while assembling and welding and distortion avoided by following the proper welding procedure. Typical examples of using a simple fixture are shown in Fig. 1. From top to bottom, the operations are welding rings together and holding them to a definite size, placing motor frames in a locating fixture that is designed to hold the parts in alignment and shorten assembly time, and tack-welding the parts of the twin frame after they have been accurately located in the complete fixture. Fig. 2 illustrates checking of the completed structure after final welding and annealing.

When practical, it is desirable to design parts so that most of the welding may be done in the automatic machine and advantage taken of lower costs and more reliable welding. The motor frame in Fig. 3 is an example where this can easily be done. It is more difficult to follow the same procedure for such parts as shown in Fig. 4, where the size is such that the welder must work on a platform. In this case, the manipulator that handles the work has its controls mounted on the same panel with those for the welding machine and within easy reach of the operator, so that the part and the welding machine can be operated from any position that the operator takes.

HANDLING FIXTURES LIGHTEN WELDER'S TASK

Many welding operations cannot be made with the automatic equipment, and providing handling fixtures, such as that shown in Fig. 5, is often desirable, to aid the operators to position the pieces for down hand welding with minimum effort. Fig. 6 illustrates a large supporting bracket for a vertical generator which would be an awkward piece to handle for down hand welding without equipment to position it readily. Mounting large parts so they can be handled safely and mounted

quickly is the main problem to be solved in the successful use of such equipment, as they are adaptable for both automatic and hand welding, and positioning can be controlled from any desired station within reach of the operator. Many pieces that are of such size and shape that it is impractical to provide equipment to position them are moved with a crane from one position to another or held in place while welding, as illustrated in Fig. 7.

Fig. 8 shows one section of a vertical-generator frame, illustrating the progress made in reducing the number of pieces required. The quantity of weld metal to be deposited usually varies directly with the number of pieces to be welded together; therefore, this has influenced design of machine parts to a greater extent than placing of parts to facilitate welding and assembly.

Where weight limitations will allow, using plates of sufficient size so that they do not require supports or braces for stiffness is usually found more economical. In some cases, forming the lighter plates to provide stiffening sections is cheaper than welding on extra pieces for that purpose. Fig. 9 shows a gear housing where steel castings and heavy plates have been used with limited bracing, but further improvements might be made with a better understanding of all the economical problems involved. All structures, however, reflect, in their design, the type of tool equipment available in the manufacturing section.

COOLING AND VENTILATING STRUCTURES PRODUCED BY WELDING

Improvement in welding rods and technique of their application has made possible easy production of large-frame structures for using hydrogen gas as a cooling medium for generators, synchronous condensers, and frequency-changer sets. These machines must not only be practically leakproof with hydrogen, but explosion proof if a favorable mixture of air and hydrogen should be present at any time.

Use of double welds at the important points where they can be checked for leaks by introducing air pressure between welds enables leaks to be repaired as each weld is completed, so that when the final structure is ready, only a few repairs are necessary. The final test requires that the completed frame will withstand a standard hydrostatic test for boilers and a time leakage test with hydrogen. Fig. 10 shows the generator frame for the 60,000-kw machine of a frequency-changer set, and Fig. 11 illustrates the completed set installed. Fig. 12 is the frame of a hydrogen-cooled turbogenerator, showing a ventilation-passage construction used to stiffen the frame structure and an unusual eccentric location of the stator laminations to allow the water coolers to be placed at right angles to the axis and above the frame center.

Fig. 13 illustrates the adaptability of welded construction for large direct-current armatures where heavy arms are used for providing ventilation, acting as blowers in forcing air through the ventilating ducts in the laminations as well as mechanical supports for the structure. The steel-ring end plates are shrunk on and doweled to the arms to hold the laminations and take the torque.

A number of rotor spiders that are highly stressed in the rim section have been made by rolling concentric rings, welding them completely through at the ends, machining the two rings and the hub assembly separately, and then shrinking the rings one at a time on the hub assembly so that the rim is prestressed the required amount to avoid stresses in the welds on the arms. The rim welds are placed 180 deg apart in the assembled spider which is shown in Fig. 14.

Although much progress has been made in constructing economical machine parts by welding, many more savings can be made in the development of better assembly and handling methods and the design of simpler structures than in the actual application of the weld metal even though we are still making satisfactory progress in the art in developing welding rods that produce more satisfactory welds at greater speeds.

FIG. 14 ROTOR FOR ALTERNATING-CURRENT GENERATOR

The Simian Basis of HUMAN MECHANICS *or* APE TO ENGINEER

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MY SUBJECT should not be construed by the refined as a malicious innuendo, nor by the vulgar (unrepresented here, of course) as a "dirty dig." The transition from ape to engineer is from the ridiculous to the sublime—or, at any rate, from a little short of one to a little short of the other. This handsome statement must serve as my panegyric on mechanical science. As an anthropologist, I am perturbed by the fact that human invention has outstripped man's organic development, and his control of nature his control of himself. So I propose to discuss the organic basis of mechanical achievement and the cause of man's physical and social lag in relation to his material progress.

THE ANATOMICAL ANTECEDENTS OF THE CULTURED ANIMAL

Man is the only cultured animal, and human culture is but the product of a superior animal organism. We must examine the paradox of a living being which creates inanimate things more powerful and more nearly perfect than itself, with potentialities either for the salvation or the destruction of the inventor. The human organism is no up-to-date machine. It is like a horseless buggy which has undergone a series of reconstructions. The tires are flat; the body is battered and obsolete, however much paint may be smeared on the radiator; but the engine still runs and the machine still advances, as long as the steering gear works. Abandoning this simile, which is only a sort of sop to engineers, I will recall the successive stages of human evolution, beginning with the lowest members of our primate order, who were already in existence some sixty millions of years ago. First we have a long-snouted, small-brained, tree-dwelling quadruped, about as large as a squirrel, equipped with five flat-nailed digits on hands and feet, of which the innermost—thumb or great-toe—can grip one side of a bough, while the outer four digits grip the other. This is the lemuroid stage. Next we have another small animal which sits erect in the trees, having specialized its hind limbs for support and for hopping, while its grasping hands are used to feed itself and explore its surroundings. This beast has a shrunken snout with eyes which are moving from the sides of the face to the front, so that both can focus at the same time upon an object being carried to the mouth. The brain is larger and the head, with its shorter muzzle, is less ill-balanced upon the end of the upright spine. This is the tarsioid stage.

Next we have a considerably larger animal, with hands capable of encircling thicker boughs, which tends increasingly to move by swinging from one hand hold to another, the body suspended by the arms, and the legs trailing. The snout has continued to recede; the eyes are completely frontal, and stereoscopic vision, which gives depth and perspective, has arrived. There is the rudiment of a brow and the tail has shrunk to a vestige. The ears are no longer erect, mobile, and pointed, but crumpled to the sides of the head; the viscera are hitched up with sheets of membrane to keep them from sagging when the trunk is vertical. I have described a telescoped, super-monkey, sub-ape stage of primate evolution. Next this animal, having become too large, too hungry, or too smart for life in the trees, takes a chance on the ground. In order to see the better and to have its hands free for fighting and feeding, it rears up and stands upon its unsteady legs. The flexible, prehensile feet gradually become strengthened to bear the weight of the body; the lesser toes shorten and the great toe loses its thumb-like mobility so that the foot can no longer grasp. The legs become longer and more powerful; the pelvic girdle expanded and flattened as a transmitter of total body weight and a framework for attachment of the great muscles used in standing and walking. The spine gets a forward kink above the pelvis which serves to erect the trunk; the tail remnant has sunk beneath the buttocks and forms a part of the pelvic floor; the chest has been flattened from front to back by altered gravitational pull; the arms have become shorter and the hand refined from locomotive duties; the tip of the thumb can now be opposed delicately to the tips of the outer fingers. The teeth have become so reduced that the lips are outrolled; the bony nose with its fleshy tip has grown and bloomed; the eyes, formerly recessed under a jutting bony shelf, now peer from beneath the base of an incipient dome; the brain case has exceeded the size of a grapefruit and now resembles an overgrown cantaloupe. This nearly human animal is all ready to contrive tools and to use them, thus beginning a career as master mechanic of the animal kingdom, which makes him, perhaps, in the course of a million years, a member of The American Society of Mechanical Engineers.

All of the items of organic equipment which have enabled man to produce the marvels of mechanics are a part of his primate inheritance. The first are the sensitive mobile hands with their opposable thumbs. The grasping extremeties, hands and feet, with their five digits, are an ancient vertebrate character, observable in a crude form in some reptiles. In the little lemurs the great diameter of average tree branches, relative to the size of the prehensile hands and feet, forces them to plaster the palms and soles tight against the bough, with the inner digits directed at an angle of almost 180 degrees with the outer four. Often the index finger is reduced to a stump. There is little development of manipulative skill in the users of this clinging or perching grasp. When primate animals of larger size develop, the rotation of the thumb and its opposability to the finger tips begin to come into tactile and exploratory use. In the larger monkeys and apes the hands are big

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enough to permit a large and heavy object to be held in one, while the animal tears at it with the other or with its teeth. But the tree animal has to sit up to have its hands free for feeding, fighting, or other purposes. Having to sit up or down in order to use your hands is not conducive to two-handed experimentation or to the making of tools, when you are perched precariously in a tree. A sitting monkey usually holds on with both feet and one hand, and has but one free prehensile member, unless equipped with a grasping tail. On the ground some macaques and baboons may stand on three extremities and pick up objects with the free hand, but whether in arboreal or terrestrial life, one free hand is not enough.

Sitting up develops balance and encourages the animal to use its eyes rather than its nose. It takes the eyes off the ground and enlarges the range of vision. No mechanical achievement springs from developing the primitive sense of smell. On the other hand, acuity of vision, the ability to judge distances accurately and to record impressions of form, to remark relations and generally to observe, are primary requisites for an animal which is to become a mechanic. It is at this point, possibly, that the brain begins to step in and play a preponderant rôle in the coordination between the eyes and the hands which ultimately results in the creation of a material culture. Next to the sensory and motor areas of the nervous covering of the brain, there grow up regions in which movements are pictured, and beyond them, probably, those mysterious brain tracts which provide for association, memory, and creative thinking.

But no animal up a tree can initiate a culture. The realization of the possibilities of stereoscopic vision, emancipated hands, and an elaborate nervous organization had to await the descent to the ground. In arboreal life the animal must ever contend against gravitation, be on the alert to maintain his balance. He has no firm footing. Our ancestors, wisely or fortunately, descended from the trees and eventually stood upon their feet on the ground. The stabilized supporting foot is nearly as essential for tool producing as are the free hands with their opposable thumbs. For no effective use of tools or weapons would have been possible for an animal which suspended itself by the arms from the trees, or for one which stood and moved on the ground on all fours. It was quite as necessary that the foot be remade as that the hand preserve and perfect its primitively mobile digits. The adaptations undergone by the spine, the pelvis, the lower limbs, and the foot, enabled the animal to get his whole body into a single vertical axis and to poise the center of gravity over the bipedal base of support. This base of support could be widened or lengthened by shifting the feet, according to the exigencies of the ground surface, or the balance required by varied movements and positions of the arms and torso, in the carrying of weights, the wielding of tools or other manual activity. Moreover, the erect posture and biped gait, as a result of perfected arrangements of the bodily mechanics, soon became so effortless and so automatic, that the animal acquired the ability to walk or run while still employing the hands in unrelated and skillful movements. The locomotor and supporting appendages were emancipated from the prehensile members.

Thus it appears that before a primate can become an engineer he has to have a series of very complicated engineering jobs done upon him by a firm of biological engineers which we may call Variation, Adaptation, and Natural Selection, Unlimited.

REFLECTIONS OF PREHUMAN MECHANICS IN ANTHROPOID APES

A clearer understanding of the primate background of human mechanics may be gained from the study of the use of implements in monkeys and apes. Prof. Robert E. Yerkes, of Yale, an authority on primate behavior, does not think that primates below the level of monkeys make any use of movable objects as tools or implements. There is no doubt that some monkeys display considerable dexterity in the handling of objects. However, Yerkes has known intimately only one monkey which he considered had an aptitude for the use of implements, and this gifted individual merely played with human tools. De Haan, however, experimented with an American monkey which, in the use of a variety of implements, was judged to be more intelligent than any anthropoid ape except the chimpanzee. Most of the experiments of psychologists have as their object the testing of the intelligence of an animal, by setting it a problem which may or may not require for solution the manipulation of objects in a purposeful way. The use of tools is usually only incidental to the problem.

Experiments with the gibbon, the small anthropoid ape, seem to indicate no more mechanical ability on the part of that animal than is displayed by monkeys. Given a rake with which food may be secured, the animal will draw in the food if the latter is in front of the rake, but will not attempt to place the rake behind it for the purpose. Dr. C. R. Carpenter states that the gibbon, which has very long fingers and a very short thumb, makes comparatively little use of the latter in handling food or other objects. The short thumb is pressed against one of the middle joints of the fingers rather than opposed to the tips, and instead of picking things up by gripping them directly between finger tips and thumb, the gibbon uses a sidewise scooping method.

On the whole, the gibbon is narrowly specialized for tree locomotion. Its arms are so long that they reach the ground when the animal stands erect. It swings by its arms from bough to bough and from tree to tree, easily clearing spaces of twenty feet. Although the great length of the upper limb is a mechanical advantage in moving the body weight by brachiation (arm-swinging), it is decidedly the reverse in the skilled handling of objects. Such long arms require too much elbow room, and the very extension of the forearm, which is the fixed lever in arm locomotion, interferes with quickness and precision of movements when the hanging upper limbs are flexed in lifting objects and the forearm becomes the movable part of the lever. But it is mainly deficiency of brain and not excess of arm which prevents the gibbon from being an engineer.

The orang-utan, a much larger and stronger animal, is also handicapped in tool using by excessively long arms and short thumbs. However, this ape is easily taught such high human accomplishments as eating sliced bananas with a fork, lighting a cigarette, riding a bicycle, driving nails, and selecting the right Yale key with which to unlock a box. One of Hornaday's orangs used the bar of his trapeze as a lever to enlarge the opening between the end bar of his cage and the concrete partition, so that he could get his head through and look into his neighbor's house. Thus curiosity is the father of invention. Often orangs twist the straw from the cage floor into ropes, and use them for swinging from trapeze bars. Yerkes set a problem for his orang-utan, Julius, in which the animal was supposed to pile up boxes beneath a banana suspended out of reach, so that he could climb the pile and get the fruit. Julius was very slow in solving the problem with boxes, but when given a pole, he improvised a perch between the corner bars of the cage, and reached the banana by swinging or leaping from the perch. If I understand Yerkes correctly, Julius also got the banana by pole-vaulting for it. His brightest achievement, not mechanical, was to coax Professor Yerkes to stand under the banana so that the ape could climb the professorial ladder. Julius could not learn to unlock a padlock with a key, perhaps because he belonged to the period of Yerkes' sojourn at Harvard, so that he was not allowed to use a Yale key. Yerkes

thinks that, on the whole, the orang-utan is not mechanically gifted, although more intelligent and adaptable in the use of tools than the gibbon. Nevertheless, the orang is apparently profoundly uninterested in engineering.

The chimpanzee, a much more tractable and sociable animal, is the favorite ape for experiments, and the most accomplished and inventive in the field of tool-using. Köhler has pointed out that certain defects in the chimpanzee's perceptions interfere with his mechanical progress. He does not distinguish between a part and the whole if they are spatially connected. If a table is placed in the corner of the room, so that its surface appears to be joined to the walls, the chimpanzee will pass it by in his search for a movable object. He generally fails also to distinguish between a cord which is tied to a basket of food outside of the cage, by which the prize may be drawn within reach, and a cord which merely touches the basket. The odds are even that he will pull the wrong string.

Köhler also finds that the chimpanzees have little idea of statics. They cannot learn to make a stable pile of boxes. A large box will be placed precariously on top of a smaller one, and the animal standing on the summit of the shaky pile may even attempt to pull out one of the bottom boxes to add it to the top. The chimpanzee will attempt to stand a ladder vertically under a suspended object and climb up. If the object is hung close to the wall of the room, the chimpanzee will set the ladder flat against the wall, or edge against the wall. The animal's understanding of statics is impeded, and at the same time compensated by its own organic statics—i.e., those of its labyrinth and cerebellum. For the chimpanzee is a natural equilibrist. When he piles up a wobbly and unbalanced structure of boxes, which will topple over if left to itself, he often succeeds in mounting it and balancing it by his own weight long enough to enable him to grab the banana. Again, he is able to set the ladder flat against the wall and climb up it before it falls or even hold it vertically in the middle of the cage, run up it, seize the prize, and jump. In other words, he accomplishes a physiological achievement without a mechanical solution. Nevertheless, these animals do not have an absolute lack of insight into statics: They do not try to suspend a box in thin air and when they use a pole as a jumping stick from the top of a box, they do not attempt to rest the end *in vacuo*, but on the box—although perhaps on its very edge. Köhler thinks that visual orientation in space, the fixed idea of "above" and "below," develops gradually in human children as a result of the habitual upright posture of the head, whereas in a chimpanzee the head is just as likely to be held upside-down, and lack of such firm orientation inhibits the development of statics. The chimpanzee lacks the incentive for the development of statics because of his natural gifts as an equilibrist.[1]

The one gorilla investigated by Yerkes, a young female named Congo, in tackling the problems of utilizing poles, boxes, et cetera, showed a high degree of ineptitude. In fact, Yerkes calls her a "moron in mechanics," but notes that this kind of moron may be capable, nevertheless, of various kinds of imaginative adaptation.[2] I gather that he is of the opinion that such mechanical morons may be accidents which happen even in the best of families—the Hominidae—and especially in the females.

The question of handedness, footedness, and eyedness in the anthropoid apes has been insufficiently investigated. The preference for the use of one foot, one eye, and one hand, and the involved specialization of the controlling side of the brain is of enormous importance in man's mechanical achievement.

[1] "The Mentality of Apes," by Köhler, pp. 139–172, N. Y., 1925.

[2] "The Great Apes," by Robert M. Yerkes and Ada W. Yerkes, p. 513, New Haven, 1929.

But even in human beings the implications of bilateral asymmetry and specialization are little understood. Only comparatively recently, educational psychology has discovered the serious extent to which children who are not right-eyed and right-handed, nor yet left-eyed and left-handed, but unspecialized, are handicapped in most human learning processes. Yerkes thinks that preferential use of the members of one side occurs frequently in the anthropoid apes, but does not commit himself to positive statements as to handedness and eyedness in the different apes. But it is fairly clear that an animal has to decide which hand to use before he can accomplish any mechanical feat with either.

Certainly the lack of speech is an insurmountable obstacle to the transmission of culture in the ape. When each individual has to discover for himself, or to learn only by exemplification, there can be little or no diffusion of the inventions of the mechanical mind to the ungifted who are capable only of utilization. In the last analysis, however, there is but one fundamental reason for man's exclusive possession of a material culture, for his unique understanding and application of the laws of mechanics. Man has a more highly evolved central nervous sytem than any other animal. The primitive insectivore with an infinitesimally better brain than its kind takes to tree life. The tarsier, with a slightly superior nervous endowment, sits up and begins to emancipate its hands. The more elaborate cerebral cortex of the monkey expends its excess of nervous or electrical energy in an aimless curiosity. This becomes more purposeful in the bigger brained anthropoid apes and not only adapts the organism but invests it with the quality probably shared only with man—insight. The brain begins to get the upper hand of the body. Even in the earliest of fossil men, this cerebral dominance has so far subordinated gross physical equipment of powerful jaws, big teeth, and strong grasping extremities, that these no longer require modification to enable the animal to survive. The earliest human forms we know were tool-users. When man becomes an engineer he begins to adapt his environment to himself, rather than himself to his environment. Tools make organic adaptation obsolete.

STEPS IN MAN'S MECHANICAL PROGRESS

I have been dealing with the physical and psychological background of man's mechanical preeminence. But progress in any science presupposes a society in which competition stimulates the inventive brain, while mutual aid and imitation amplify and improve its achievements. Let us examine the social basis of man's engineering progress. Perpetuation of the species is secured by success in the food quest, by evasion of, or defense against, enemies, and by reproduction with the safeguarding of offspring. At the root- and fruit-collecting and hunting stage of man's existence there is a certain incompatibility between the food quest and social aggregation. To live upon natural products it is desirable that human groupings be small and widely scattered. For purposes of mutual defense it is, on the other hand, essential that bands of numerous families be formed, if we assume, as I think we must, that the earliest forms of men had already sacrificed muscular strength and organic defensive ability to high development of the nervous system. The great anthropoid apes are powerful enough to fend for themselves in scattered family groups, and at worst they can take to the trees. Man, in becoming a terrestrial biped, incurred great risks because of his slow locomotion and his puny strength. It seems probable that the necessity which first mothered invention was that of devising weapons to eke out the inadequate strength of the lone food-collector. As soon as the contrivance of weapons of wood and stone had supplemented man's organic resources so that he could tackle

the larger game animals and become a carnivore, large social groups became feasible and advantageous. For really big animals can best be hunted down and killed by groups, rather than by individuals, and even if you can kill an elephant single-handed, you and your family cannot eat it by yourselves before its flesh becomes too "high" even for savage consumption. The antiquity of human combination into social groups is shown by the hundreds of thousands of stone implements of almost identical types which are found in widely separated parts of the Old World during the glacial epoch. Already manifold types of stone implements existed, adapted for various uses. Imitation and diffusion of mechanical achievements had begun. The use of the lever is prehuman; stone working is at least one million years old; the utilization of fire nearly as ancient, although its first artificial production cannot be dated. The harpoon and the spear are easily thirty thousand years old, as are also the spear thrower and the sewing needle; pottery and the bow may not be more than half of that age.

The domestication of plants and animals, which probably began eight to ten thousands of years ago, furnished the greatest incentive to mechanical progress. Domestication enabled man to get an adequate command of food supply, to settle down, to construct permanent abodes, and to begin the division of labor whereby the craftsman bartered the products of his skill for food. The training of the ox and the horse to perform the tasks previously accomplished by man-power enormously increased the amount of energy available for work production. All of this is elementary and obvious.

ETIOLOGY OF MECHANICAL PROGRESS

I should like to discuss briefly here, however, the respective rôles of the individual inventive genius and of the imitative crowd in the furthering of mechanical science in primitive society.

Possibly the outstanding characteristic of primitive or savage societies is their rock-ribbed conservatism. That is perhaps why many of them have remained primitive. Under these circumstances the progressive has hard sledding. People persist in doing things in the old stupid ways and in using implements which are ineffective and obsolete, merely because of the ease with which motor habits are formed and the impermeability of the low-grade brain to new ideas. The innovator in the field of mechanical science is regarded with suspicion, fear, and hatred, because his inventions are misunderstood, and because they seem to give him an unfair advantage and to depreciate the time-honored methods, inferior tools, and lesser ingenuity of the ordinary worker. These observations are valid in primitive societies and probably held true in civilized nations up to the last century. Only within that time have innovations become the rage because of industrialization. The primitive inventor had to overcome a far greater inertia of stupidity and conservatism than it is easy for us in our mechanical age to conceive. He had to possess not only the mental ability to formulate mechanical principles and to translate them into working models, but also the moral courage to persist in the contrivance and use of the novelties which made him suspect.

The almost incredible duration, through scores of thousands of years, of identical types of coarsely shaped and inefficient flint implements, probably reflects the struggle of the human organism to accustom itself to extraorganic aids. It suggests even more forcibly the suppression of the gifted innovator by the unprogressive horde. It is almost treasonable to argue in this democratic society that social, material, and intellectual progress has never been a communal achievement—a sort of immaculate conception of the group mind—but always the result of the effort of the gifted individual. The genius, mechanical or of any other sort, seems to be due to a fortuitous combination of superior mental qualities which from time to time is dealt from the shuffled pack of hereditary units. Civilization has advanced, in my opinion, not because of any improvement of mental quality in the masses within the last ten thousand years, but rather because the realization of the material advantages to be gained from the toleration of genius has slowly percolated into the torpid minds of the majority of our species. This very reluctance to adopt a new and better idea or device carries with it a tenacity in the retention of such material cultural improvements as have won acceptance. Consequently, little utilitarian mechanical knowledge is lost, and there is a slow, cumulative transmission of the scientific achievements of the past. Thus when the rare genius comes along, he is enabled in successive ages to take off his flight from higher structures which have been painfully built up by his gifted predecessors, consolidated by subsequent utilization, and sanctified by custom.

EFFECT OF TOOL-USING UPON THE ORGANISM AND UPON SOCIETY

Let us now consider the effects of tool-using in a complex society upon man's organism and his biological future. There can be no doubt that modern mechanical science is partly responsible for the diversion of human evolution into smoothly engineered highways upon which we are coasting recklessly downhill. Let me recapitulate for a moment. Man raised himself above the level of the brute ape by developing a superior brain which enabled him to bolster his physical weakness by the use of extraorganic tools. A succession of achievements along this line very quickly made him monarch of all he surveyed—lord of the fowl and the brute. Unsatisfied with dominance of animate nature, he has proceeded, with some success, to attempt to harness the forces of the universe. Why should any one carp at such a stupendous performance? In the first place, I think that we may assume that any living organism, by its metabolic processes, can convert into vital energy, for growth, for reproduction, or for the performance of work, an amount of food which is rigidly limited by various organic restrictions. By means of hormones, or chemical messengers, the secretions of the ductless glands direct varying amounts of energy to different parts of the organism, according to the insistency of their several demands. The active part receives the nutriment it requires; it enlarges. The idle organ is kept upon starvation diet and shrinks. The ascendant phase of human evolution emphasized cerebral development because the brain was actively functioning in order that the species might survive by mechanical progress. At the same time, this brain trust was robbing the rest of the body, but to some extent of ill-gotten gains accumulated during the brutish stages of higher primate development, when the giant anthropoid apes (including our ancestors) got the bulge upon the monkeys, simply by becoming gigantic, formidable, and fearless. The increasing use of the brain both directly diverted nutriment from other parts of the body, and indirectly, through creation of tools, diminished the work which had to be done by the hands, arms, legs, and teeth. These less active organs decreased in size, and atrophy brought also impairment of quality and not infrequent pathology. Up to a point, the recession in muscular strength and in masticatory and digestive ability was perfectly all right. No man has need of the strength of the ape (unless he is a professional wrestler or that supreme product of higher education—a football player). But he ***ought*** to need the brains of a man; he should not be able to survive and to flourish with the mental equipment of a moron.

At first, mechanical science merely devised tools which would utilize more efficiently the supply of human energy convertible into work. Use of these tools required muscular exertion,

manual skill and coordination, and a considerable mental effort. Thus a sort of organic equilibrium in evolution was maintained; the brain was not overfed; the body was not markedly atrophied. The mischief began when mechanical genius began to contrive tools which facilitated the performace of work with little or no cerebral exertion. In the conversion of raw products, the individual was allowed not only to stop sweating, but also to stop thinking. While he did work with tools requiring a minimum expenditure of physical energy, his brain went on a vacation.

The industrial age involves an elaborate social structure with a minute division of labor. The object of this organization is the mass production of material culture with the supposed purpose of furnishing cheaply to most of mankind things which will make life easier and happier. The ideal of popular distribution of invented products has, to a great extent, been realized. It is unnecessary to regurgitate here the well-masticated question of the social and biological effect upon human organisms of their being transformed into units for this mechanized production. The working days of these human cogs are spent in performing with precision and rapidity a short series of skilled movements which become more or less automatic, but still require attention. The effect of such a life upon the nervous system, upon the mind, and even upon the muscular and other functions of the body is devastating. Such an infinitesimal human unit in a production machine can scarcely realize from his labors that sense of creation and pride of craftsmanship which are the incentives that make the engineer.

The anthropological effect of mechanization upon the users of these super-tools is mainly maleficent. Primitive conditions require the individual to be physically and to some extent mentally active throughout his short span of life, if he is to survive and perpetuate his kind. Demands upon his organism are symmetrical, though rigorous. Natural selection and social selection eliminate the physically inferior, the manually inept, and to some extent the mentally dull, because each man creates his own tools and survives through his ability to use them. Intelligence advances in step with mechanical ability and bodily fitness. However, when human ingenuity contrives machines which increase almost infinitely the individual's control over matter, the struggle for survival and the checks against population increase are largely nullified. The physically and mentally inferior multiply with astounding rapidity, partly because their feeble capacities for productive work are, nevertheless, sufficient to make them cheap, but essential adjuncts to the machines which play the larger part in goods production. Mechanical conversion of natural resources into food and other human essentials permits the survival of the low-grade biological specimen on a level of adequate nutrition and comparative idleness which would have been unimaginable for the primitive being, even if he were at once a mental genius and a Hercules. A majority of the population exists parasitically upon the inventive genius of the few, with little exercise of its meager intelligence. The mechanical contrivances which eliminate the necessity of thought, judgment, and skill in the user are almost equally available for the use of the moron and the criminal as for the intelligent and the socially minded. The vast potentialities of these tools are used more and more for evil, as they become perfected, cheaper, and more easily accessible. Machines get better and better, while man gets worse and worse. The extra-organic tools are no longer accessories; the tail now wags the dog and even thinks for him. It remains for the other end only to bark and bite.

The once erectly striding biped abandons human locomotion and whizzes through the landscape, crouched over wheels and levers worked by his still prehensile hands, and his flat, vestigial feet less useful for this purpose than those of his simian ancestors. He breathes a mixture of gasoline fumes and carbon monoxide and reeks of evolutionary decay. A premium is put upon illiteracy by the radio and the talking moving picture. These mechanical marvels are the means of world-wide spread of vulgarity, depravity, and misinformation, since they pander to the tastes of those who are capable neither of contriving nor understanding but only of crude sensory perception, stimulated by turning a switch or pressing a button—motor performances within the capacity of a lemur. Truly, man can say to the engineer, "The zeal of thine house hath eaten me up."

Now I have purposely painted a somewhat lurid picture, which may be thought a caricature, and is not likely to win admiration or to give pleasure. As a matter of fact I wish to do neither. When nearly all of mankind insist upon regarding themselves as godlike creatures, he who harps upon the apish basis of the human organism and the possible reversion to an apelike behavior, cannot hope for popular acclaim. I do not wish to depreciate the virtually superhuman achievements of pure and applied science; in fact I aspire to be regarded as a humble sort of scientist myself—possibly an impure practitioner of an unapplied science. It is my purpose, rather, to emphasize the possibility that man's mechanical science (the product of a few) has so far outstripped his biological status and his social ideals and behavior, that it has become a menace. What are we to do about it—call a moratorium upon mechanical endeavor and progress until man catches up with his machines? I think not.

What we must do is to divert a modicum of that high intelligence and creative ability which is too nearly monopolized by mechanical science to the study of ways and means of repairing and improving the human machine. We must remember that we are still animal organisms, and that the higher animal elevates himself only by striving to exercise to the full his organic functions. Degeneration and evolutionary extinction are the fate of the living thing which becomes so dependent upon a specialized environment that it loses the power of adaptation, of initiative, and of progress—literal and figurative. It is no more profitable to man to become a slave to the mechanical contrivances of his own mind (or of others' minds) than to become a parasite upon anything else in nature.

Man made himself out of an ape, partly by becoming an engineer. The danger now is that the process will be reversed and the engineers will make apes of all of us. We apes shall then destroy ourselves and hoist the engineer with his own petard. My firm conviction is that we must build the future of humanity, if there is to be any future, not upon mechanical science which is up to this point the greatest human achievement, but upon man's biology about which we know virtually nothing at all. If man can make machines which are better than himself, cannot he make himself better? We do not need more automobiles, we need fewer fools in the driving seats; we do not want mechanical robots, we want human animals who still have brains; not more jails, but fewer criminals; not perfected weapons of war, but peace. The gorilla can manipulate human tools, but he uses them destructively. There is but one way of making a man, and that is the biological way. There can be no stability of civilization, when the human biped totters, and he cannot be propped effectively by law, by education, by religion, or even by mechanical inventions. Breed better animals by selection and elimination of the inferior; study the transmission of those organic capabilities stored up by our species through the millions of years of primate evolution which have culminated in man. You will then conclude that it is man who makes the tools, and that only men, not morons or apes, may use them for the betterment of humanity.

NATIONAL APPRENTICESHIP

A Working Truce in One Sector of Industrial Relations

By WILLIAM F. PATTERSON

FEDERAL COMMITTEE ON APPRENTICESHIP TRAINING, WASHINGTON, D. C.

THE RECENTLY enacted Fitzgerald bill, making the Federal Committee on Apprentice Training a permanent agency and relating it more closely to labor standards by placing it in the United States Department of Labor, recognizes the place of apprenticeship in America's industrial future. Although in the past a number of excellent apprenticeship systems have been maintained by private industry and by employee organizations, we have never had in this country any uniform national system of apprenticeship. The existence of the Federal Committee has grown out of the pressing demand for a coordinating agency to draw upon the experience of management and of labor in assisting them to set up standards of apprenticeship for a trade or industry which would be acceptable to everyone concerned.

In this process, we have had under observation one whole sector of industrial relations where cooperation has not only produced immediate results in the field of apprenticeship but also gives promise of that mutual trust and understanding of each other's objectives and problems which should make for better industrial relations in the future. It is axiomatic that the skilled worker of tomorrow will be the graduate of today's apprenticeship; that management looks also to apprenticeship as the field from which to recruit its future foremen and superintendents.

STANDARDS ESSENTIAL TO GOOD APPRENTICESHIP SYSTEM

Basic to the problem of apprenticeship today is the question of standards. To the engineer whose professional training and career are geared to exacting and scientific standards, who must depend on the highly skilled worker in industry to translate his ideas into actual work processes or products, this fact is self-evident. Those engineers whose careers have shifted over into the field of management are among the forward-looking employers who recognize the need of apprenticeship of a high order. Equally progressive representatives of labor have always advocated apprenticeship. Maintaining justly that holding a union card should guarantee a high degree of skill, they have attempted to raise apprenticeship standards for their trades.

Thus, in a sense, apprenticeship might be said to be an engineering problem in its preoccupation with standards and in its need to utilize the best brains and experience on the subject. It is a question of routing the young person through the best apprenticeship procurable. Various points of view must be gathered up into the controlling one of what is best for the apprentice. This means balancing management's contribution on the job and its point of view with that of labor and the real contributions that labor can make out of its long, inherited work experience to the end that apprenticeship shall become an integral and efficiently functioning part of our industrial machinery.

Standards grow out of the reality of the situation. They are concerned with what the apprentice needs to become a skilled worker, what management and labor conceive to be their part in the making of that skilled worker. Thus, it seems almost academic to speak of cooperation on the question of standards as an abstract thing. Wherever management and labor have been honestly concerned with procuring the best possible standards on apprenticeship and have asked the assistance of the Federal Committee in working out those standards, we have not lacked cooperation. It has been a small working laboratory in which a common aim for common good has brought about the necessary cooperation to secure that end.

By standards we mean, briefly, assurance for the young person who becomes an apprentice that (*a*) he will receive a thorough and well-rounded work experience, with determination in advance of the various processes or operations of the trade and the time to be allotted to acquiring skill in each branch, so that he will have thoroughly mastered all essential branches by the end of his apprenticeship; (*b*) he shall be given at least 144 hr per year of related school instruction; (*c*) his wage at the start will be large enough for him to live on and yet such that the employer can afford to spend time and effort on his trade preparation, a standard that is generally set at 25 per cent of the prevailing rate for journeymen; (*d*) as the skill and knowledge of the apprentice increase, the wage scale shall advance at regular and stated intervals, so that over the period of apprenticeship it averages 50 per cent of the journeyman's wage; (*e*) machines or processes at which the apprentice works shall be properly safeguarded; and (*f*) he shall be protected against overtime; in short, that his hours and conditions of work shall conform to accepted standards for regular employees in the industry. All these safeguards in the interest of both employer and apprentice, all these safeguards in the interest of turning out a highly skilled worker at the end of the apprenticeship, should be embodied in the written agreement that is to be signed jointly at the outset by the apprentice and his parents and by the employer. In fact, the written agreement has proved itself to be a basic standard in apprenticeship.

EMPLOYERS AND EMPLOYEES COOPERATE IN SETTING STANDARDS

Mutual action on the question of standards is largely a matter of give and take. Where demands are felt to be arbitrary, joint consideration can get them carefully worked out on the basis of actual requirements from year to year. Fundamentally, on questions of apprenticeship little difference will be found in the thinking of employer and employee groups. Once they get together, they find that they see so nearly eye to eye that small difficulty exists in working out standards. It is largely a question of machinery. On the other hand, wherever management and labor are at sword's points on the matter of apprenticeship standards, wherever the employer comes out with scareheads on the scarcity of skilled workers and labor insists that no such shortage exists, an apprenticeship program will make small headway. It will be an impasse. Moreover, instruction that the apprentice receives on the job is most often dependent on the good will and cooperation of the journeyman he works

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under. Unless the journeyman feels that his point of view as a worker has been given due consideration, such cooperation and good will are often lacking.

In helping to develop national standards for an industry, the Federal Committee has made direct contact through its field representatives with national employer and employee organizations. Where they could not be actually brought together in joint representation on a committee, the Federal Committee has consulted first with one group and then with the other and has acted as intermediary in working out their common aims in apprenticeship and recommending uniform national standards.

An outstanding example has been the establishment of national standards by the plumbing industry. The National Association of Master Plumbers and the United Association of Journeymen Plumbers and Steamfitters of the United States and Canada, with the Federal Committee acting as coordinating agency, have approved and set up five-year plumbing-apprenticeship standards. These standards have met with widespread favorable reception, with the result that local apprenticeship committees are now functioning under national standards in 53 cities, representing every portion of the country. Already, 600 apprentices have been placed under these national standards. The painting industry has also worked out and put into operation national standards, and leaders in other industries have requested the Federal Committee's assistance in working out national standards.

JOINT TRADE-APPRENTICESHIP COMMITTEES THE SYSTEM'S BASIS

The foundation of the structure is local joint trade-apprenticeship committees, on which employers and employees are equally represented. These committees are practically autonomous and are free to determine the schedule of preparation needed for apprentices in their particular industry, each industry naturally having the best knowledge of its own apprenticeship problems and needs. They carefully work out specific provisions of the agreement, including safeguards for both employer and apprentice. In addition, they decide upon (*a*) the ratio of apprentices to journeymen, (*b*) minimum age for beginning the apprenticeship, (*c*) schedule of processes, (*d*) related instruction, and (*e*) wage scale. Some 1200 of these local joint trade-apprenticeship committees are now functioning.

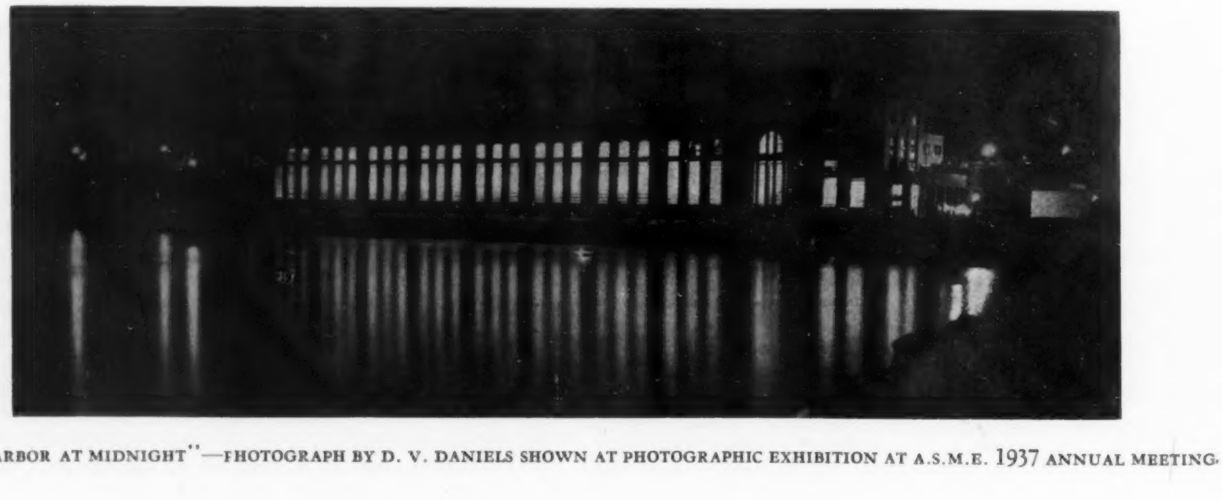
Meanwhile, employers' associations and employees' organizations in many trades and localities are setting up apprenticeship systems with standards patterned after those recommended by the Federal Committee. Thirty such local apprenticeship systems were established between January 1 and July 1 of the current year in 11 states, and among printers, machinists, electrical workers, bakers, millmen, and sheet-metal workers, to give random examples. Eventually, these scattered local apprenticeship systems are expected to coalesce under national standards for their particular trade or industry.

The importance of national standards cannot be exaggerated. They make for mobility of labor, protection of the employer who has taken pains to give his apprentices sound preparation and who may under national standards reasonably hope for cooperation from his fellow employers, and protection of young people who are thus assured of sound preparation for entrance into industry or a trade. The benefits of such a national apprenticeship system are accruing to industry, to labor, and to the country as a whole. Apprenticeship on a sound national basis is now recognized as essential by leading industrial groups from The American Society of Mechanical Engineers to the Machinists' Union and from the American Institute of Architects to the Bricklayers' Union.

The House Committee on Labor, reporting in favor of the Fitzgerald Bill making the Federal Committee on Apprentice Training a permanent agency within the United States Department of Labor, summed up as follows:

> The economic progress of a great industrial nation like ours is largely dependent on the skill and genius of its workmen. It is surprising that definite national steps were not taken long ago to assure an adequate supply of skilled workmen and at the same time to provide young people much-needed employment in the trades.
>
> A few of the more forward-looking individual employers, employers' associations, and trade unions have carried on excellent apprenticeship programs, but these have afforded opportunities to but a few of the thousands of young people who should benefit from such training. Those who have conducted sound apprenticeship programs are the foremost advocates of a nationally integrated apprenticeship system.
>
> The employer supplies the job and the facilities for training. The workers have the skill and do the actual imparting of skills to the apprentices. There is a mutual interest between the employer and the workers in proper standards for apprenticeship. Distrust and suspicion often develop when either one or the other undertakes the training program alone . . . . The experience of this close cooperation between management and labor on questions of apprenticeship may be expected to influence beneficially other negotiations between management and labor, with consequent benefits to the whole nation.

To the engineer who uniquely among professional men is aware of the need for skilled workers, the Federal Committee on Apprentice Training looks for active cooperation and participation in its objective of establishing standards for a sound national apprenticeship system in the various skilled occupations with which the engineering profession is concerned.



"SAFE HARBOR AT MIDNIGHT"—PHOTOGRAPH BY D. V. DANIELS SHOWN AT PHOTOGRAPHIC EXHIBITION AT A.S.M.E. 1937 ANNUAL MEETING

WEALTH *and* ENGINEERING

By A. R. SMITH

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WHAT IS WEALTH?

Is It Credit? No, one man's credit is another man's debt and so credit is simply transferring the possession of wealth from one person or organization to another. I wish to deal with collective wealth so we are not interested in who has the immediate control.

Is It Money? No, money is valueless except as a means of exchange. A good example of the instability of money was in Germany in 1923 when the mark was depreciated to 1/1,000,000,000,000 of its normal value.

Is It Gold? Gold is just as valueless as currency except for its durability, its universally accepted utility for exchange, its apparent stable mining cost as reckoned in man-hours of human labor, and the limited deposits.

Is It Natural Resources? This truly is wealth but only in part. As time goes on, we will be able to do more to offset insufficient natural resources.

Is It Health? Health is a vital accessory to accomplishments, and the storage of accomplishments is really the subject of my talk.

STORED ACCOMPLISHMENTS

So-called wealth is acquired by doing more work than is immediately required and storing the remainder. In early history, this work consisted mostly of common labor and was practically so many man-days of labor stored for posterity.

Those people in their latter days, or the future generation, had to do less labor for immediate needs because of the utility of that stored. Or, if they continued to do more than the immediate consumption, the storage increased.

If each year 10 per cent was stored effectively, such abundance might be available in a short time that the temptation would be to live entirely on the storage until consumed; but it does not continue to accumulate partly because it depreciates and partly because the workers introduce luxuries and refinements which increase the immediate consumption. Furthermore, much depends on the utility of the stored accomplishments.

CHARACTER OF STORAGE

Mining of coal, construction of dwellings and public buildings, building of railways and highways, and manufacture of machinery are all stored accomplishments and help the workers to produce as much as formerly with less hours of labor or to produce much more with the same hours.

Perishable products, such as farm produce, unless stored in cans, are temporary potential wealth. They must be considered in the light of a promise of succeeding crops. However, leveling of the ground, removal of boulders, and provision of drainage and such lasting facilities provide means of raising more or better crops with the same seasonal labor and constitute wealth.

LIFE OF STORAGE

The Pyramids probably represented the greatest single storage of man-days of work and long life; but, I imagine, had no value when completed and still have only historical value.

Boulder Dam, the Panama Canal, and similar undertakings are of great utility value but probably have a life of 100 or 200 years.

The modern steam plant for high pressure, high temperature, and high speed and the modern locomotive have a life of some 30 years.

Automobiles and airplanes live respectable lives for some 5 years.

Miniature golf courses and sleeping cabins are illustrative of American fads, which may have a popularity of only 1 year.

It is interesting to observe how high pressure, high speed, and high temperature are commonly accompanied by short life in the case of machinery, and this condition is paralleled in nature. The crocodile seems to me like one step from vegetation; it has no roots like a tree, still it often remains motionless for long periods. However, it has motion and a shorter life than a tree.

Human life shows a tendency toward shortening from extreme activities, high blood pressure, nervous exhaustion, and fever. The sciences of medicine, surgery, and hygiene are offsetting this tendency and actually extending the average span of human existence.

OBSOLESCENCE

Rapid advances in living conditions and human requirements make it advisable to plan our storage not for long life but for greater utility value, because it is apparent that obsolescence is becoming a bigger factor in the shrinkage of useful wealth.

The kind of products that man wants changes greatly as he develops new ideas of requirements to satisfy his desires.

Our houses may not be constructed for a long life but they are susceptible to modification. I saw some houses in Europe that were much more permanent but with their arched brick floors, multiplicity of chimneys, and such old-fashioned notions of lighting, ventilation, and living requirements, modernization was so costly as to make such wealth as much of a liability as an asset.

PURPOSE OF STORAGE

Originally, the purpose of storage was to provide the necessities of life during periods of famine, drought, pestilence, and other irregularities of nature which prevent man from producing or limit his production.

At present, the conception of storage is to provide facilities for production that enable us to have more refinements each year in the future. We do not think of it as wealth and it goes far beyond that which is required for protection.

If we plan for 5 years' storage instead of 100 or 1000 years, a greater quantity must be stored each year, or the accumulated wealth will be reduced because of the fresh start that is made every 5 years.

REDUCTION OF STORAGE PERIOD

The motor-car investment is enormous. It is rebuilt every 5 or 6 years, which seems like wasted wealth, but our more

Address at the dinner held in connection with the National Fall Meeting, Erie, Pa., Oct. 4–6, 1937, of The American Society of Mechanical Engineers.

permanent wealth in this case is the factories that can produce so many cars in so short a time. However, those factories suffer obsolescence in machine tools and the rolling mills that supply plates are being rebuilt to increase perfection and rapidity of production; so that even the factory and the mill are not permanent wealth.

While we may be shortening the life of the products, machinery to build the products becomes a new wealth. For example, natural ice used to be stored for a year or two. Now the wealth is in the refrigerator to produce that product. And, in turn, the life of the refrigerator is not long, but the factory building such refrigerators is an accomplishment that has a longer life.

Dwellings may soon be punched out in the factory; and, with baked enamel as the only dressing, may follow in the footsteps of the automobile.

Our concrete highways have to be constantly repaired against the ravages of frost and earth movement, and, when they become exceptionally uneven, may have to be removed. However, new machinery is steadily being introduced which will lay those highways with less labor in a shorter time.

When everybody lives in trailers, we can leave to our children not a home but a used vehicle which, in service or not, may be valueless by the time the will is probated. Those children, however, may inherit factories for manufacturing such houses.

TRUE WEALTH

Are we a poorer nation because of such repeated reconstruction and short-lived storage? I do not think so, because, while we may not have stored so many man-days of labor for so long a time as formerly was the practice, we have stored intelligent design and construction which form a large part of the construction of modern production facilities. For, instead of producing a product in mass, we have mass production of machinery to produce products.

Furthermore, when scientific engineering or organization effort is put into a project, it is not used up. More of such accomplishment is available when the project is completed because of the experience gained.

Modern stored accomplishments are, therefore, less static and more potential; and a large share of our wealth is the ability to do more and more not by drawing on stored products but by gaining knowledge and experience to build new things and to produce the established requirements with greater falicity.

DYNAMIC WEALTH

And, so long as we have such facilities, desires, and ability, no occasion for extensive unemployment should arise except for the faulty functioning of this complex civilization which is not so thoroughly understood in all its branches.

This sort of civilization is an ever-continuing thing. There is no stopping place. It cannot be deserted for any length of time or it will revert to seed. Some of our accomplishments may be dug up a thousand years from now, but the most important ones are those that continue only because they are alive.

We can afford to discard inefficient and useless things and reconstruct with the modern and, by so doing, carry on our backs less of the barnacles of tradition and be left free to attack our problems and enjoy our pleasures with a freedom and agility possessed by no other nation.

And who has done so much in providing a clearinghouse, free from prejudice and commercialism, for the exchange of technical information that promotes this condition? Who has encouraged this development that is the most enduring and satisfying part of our national wealth? Who will continue to foster this meritorious work in the future?

The American Society of Mechanical Engineers and associated engineering societies.

"POWER DISTRIBUTION"—PHOTOGRAPH BY J. A. LUCAS SHOWN AT PHOTOGRAPHIC EXHIBITION AT A.S.M.E. 1937 ANNUAL MEETING

COST CHARACTERISTICS *and* BUSINESS POLICY

By WYMAN P. FISKE

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IN A late issue of this periodical there was reviewed a volume concerned with the problems of planning and controlling profits.[1] These are questions of great interest, not only to business executives but also to industrial engineers. It should be clear that any sound approach either to planning or to controlling profits must rest upon the solid foundation of an understanding of the factors causing changes in profits. There recently came to the attention of this reviewer a paper concerned with certain fundamental relationships between profits and one of the most important profit factors—the cost characteristics of the business enterprise. Since these cost characteristics are significant not only in profit planning and control but also in any approach to sound business policy, examination of the thesis of the paper[2] and of its development appears worth while.

The author uses a mathematical approach to develop and illustrate the relative importance in profit determination of fixed as opposed to variable costs. Although he develops a series of formulas exemplifying the relations between profits and business volumes, he presents as his final summary "three principles of business behavior" which well express his objective points:

"(1) Fixed cost is the all-important element in volume-profit relationships.

(2) It requires less additional sales volume to compensate an increase in fixed costs than for an equal increase in total variable cost.

(3) Decreases in fixed cost lower break-even-point volume to a greater degree than do equal decreases in total variable cost."

These principles are not difficult of comprehension. To some they may appear too obvious for extended discussion. To this reviewer the simple truth expressed in them has such significance and implications as to warrant, like the simple theme of a musical compostion, extended development. Businessmen may well ponder over and study them long in order that recognition of their importance as profit and policy factors may become second nature.

The concepts of variable and fixed costs are today pretty generally understood. The author uses the common definitions. Thus a variable cost is "a constant value per unit of production;" its total "varies therefore directly with the volume of production." A fixed cost, on the other hand, "remains the same through all reasonable variations in the volume of production;" . . . "unit cost becomes the fluctuating element." He points out that many costs are hybrids, including combinations of variable and fixed costs "in various proportions." These hybrid costs may in every case, however, be broken down into an element of fixed cost and an element of variable cost, using either graphic or algebraic methods.

The breakdown of hybrid costs leaves two basic types (fixed and variable) and permits the statement of a basic profit formula:

Profit = Number of units × Selling price per unit
Less fixed cost
Less number of units × Variable cost per unit

or
$$P = NS - F - NV$$

By simple mathematical reasoning starting from this basic formula there are developed two volume compensation formulas[3] designed to determine compensating volumes to maintain either the same total profit or the same unit profit under conditions of change in either fixed charges or variable costs. Certain inherent limitations are noted. Illustrations show applications to five specific problems:

(1) What increase in volume is necessary to maintain profits in the face of a cut in selling price?

(2) What volume of sales is necessary to increase profits any desired amount?

(3) What shrinkage in sales can be suffered without impairment of profits in the face of a cut in fixed costs?

(4) What volume of sales is necessary to maintain profits when prices are cut but labor-saving machinery is installed with a resulting decrease in variable costs but an increase in fixed costs?

(5) How much increase in sales volume would be necessary to offset a wage increase?

Study of the formulas shows "the dependence of profit-volume ratios upon fixed expense." Certain implications as to business policy follow directly from this observation. Thus the amount of sales income that may profitably be spent for sales promotion and kindred expenditures depends upon the proportion of fixed charges represented by these sales costs. Greatest profit from increase in this type of cost will be experienced by those companies having a high ratio of fixed costs to present promotional expenditures and a high proportion of fixed cost to total cost. Similarly, policy in regard to meeting depression and prosperity conditions must closely follow fixed-cost characteristics. The break-even point is high for companies with high fixed costs. Stated another way, such companies are "very sensitive to changes in volume."

They are not so sensitive to small increases in cost as the company with low fixed costs. Obviously, then, the first instinct of high-fixed-cost company when faced with sales decreases will be to attempt to maintain volume by more intense sales effort or by lowering the selling price. One obvious conclusion from this discussion should be pointed out. Company Low Fixed may be content to plan only a short dis-

[1] "Working Methods for Planning and Controlling Profits," by Ronald H. Robnett, a review of "Managing for Profit," by C. E. Knoeppel, Mechanical Engineering, November, 1937, pp. 850–851.

[2] "The Mathematics of Management," by Paul Kellogg, a paper presented on Oct. 15, 1937, before the Montreal chapter of the Canadian Society of Cost Accountants and Industrial Engineers, privately printed.

One of a series of reviews of current economic literature affecting engineering prepared by members of the department of economics and social science, Massachusetts Institute of Technology, at the request of the Management Division of The American Society of Mechanical Engineers.

[3] The several formulas developed in this study are presented in **Table 1.**

tance ahead because of its comfortable position during times of poor business. Company High Fixed, with high fixed cost, must plan its operations as best it can over cyclical periods. It must try to determine what is the average per cent of capacity at which its industry can operate. Its budget must be computed at that level, regardless of present bulges or breaks. . . . The reserves that high-fixed-cost companies can accumulate during over-average years are its *only* defense for lean years.

All about us we can see the wreckage which may be traced to failure to appreciate or to remember the simple but fundamental relations with which the paper under review is concerned. To such failures may be charged bad financial policies, bad sales-price policies, and bad administrative decisions. Cost characteristics are a reflection of operating setup. Every proposal to alter this setup calls for careful analysis of its effect upon fixed and variable costs. The increasing mechanization of industry has as a corollary an increasing proportion of fixed cost. Gradually, the cost characteristics of all industry are being changed. By administrative decision the cost characteristics of individual businesses can be changed overnight. Such changes carry with them the need for a complete reversal of many policies, and have serious effects upon the profit reaction of the business to changing economic conditions. It is no overstatement, then, to say that the author was working at the very core of business policy.

It is unfortunate that so many fine products are poorly packaged. Distribution inevitably suffers. The universality of the truths pointed out by Mr. Kellogg is unquestionable. Many will shy away from appreciating this because he packages his remarks in mathematical terms. Those willing to make the effort will find the mathematics simple. The formulas finally selected are sound if not always as simply expressed as might be the case.

Thus the ratio of profit change to dollar-sales change is expressed as

$$\frac{p'}{\$'} = \frac{NS - NV}{NS}$$

and described as follows:

In any business for any given amount of change in dollar sales (assuming no changes in cost or selling price) the *corresponding change in profits will be the percentage of this amount determined by dividing the difference between present dollar sales and total variable costs by the total sales.*

This is of course mathematically correct. It might perhaps have been stated more simply and more in line with the customary business terminology if it had been described somewhat as follows:

For every increase of $1 in sales, profits will increase by that portion of the sales dollars not required to meet variable costs.

There are fundamental limitations in the mathematical approach of which the author is certainly aware but which must be mentioned as a warning to others. A mathematical formula is good only in the circumstances assumed in the premises. Care must always be taken to make sure that the formula is applicable to the particular case. Mathematical formulas also suggest a precision in results often not warranted by the raw data used. The clarity of logical development frequently prompts forgetfulness of the factor of error carried through the reasoning from the premises to the final formula. Finally, mathematics, being a precise discipline, is not too applicable to realms of opinion and judgment. Formulas serve to express relationships but must not be pressed too far in their applications. The author himself points out that "these formulas in no sense replace any part of managerial judgment."

The final note of this review must be, however, reemphasis of the significance and broad implications of the author's thesis. Specific thinking in terms of profit changes following operating or policy changes is a worth-while exercise in any business. Certainly many mistakes might be avoided if there were more of it.

TABLE 1

The symbols used in all the formulas are:

P = present total net profit
N = number of units of production
S = average selling price per unit
F = fixed cost
V = variable cost per unit
f' = projected increase in fixed cost
v' = projected increase in variable cost per unit

VOLUME COMPENSATION FORMULAS

To be used when total profit volume is to be maintained:

$$\left.\begin{array}{c}\text{Ratio of new}\\ \text{volume to}\\ \text{present volume}\end{array}\right\} = \frac{\text{Fixed cost + Profit + Projected increase in fixed cost}}{\text{Fixed cost + Profit} - (\text{Unit volume} \times \text{Projected increase in unit variable cost})}$$

or

$$R = \frac{F + P + f'}{F + P - Nv'} \quad \text{[A]}$$

To be used when ratio of profit is to be maintained:

$$\left.\begin{array}{c}\text{Ratio of new}\\ \text{volume to}\\ \text{present volume}\end{array}\right\} = \frac{\text{Fixed cost + Projected increase in fixed cost}}{\text{Fixed cost} - (\text{Unit volume} \times \text{Projected increase in unit variable cost})}$$

or

$$R = \frac{F + f'}{F - Nv'} \quad \text{[B]}$$

PROFIT-SALES RATIO

$$\left.\begin{array}{c}\text{Ratio of profit}\\ \text{change to dollar-}\\ \text{sales change}\end{array}\right\} = \frac{\text{Total dollar sales} - \text{Total variable cost}}{\text{Total dollar sales}}$$

or

$$\text{Profit-sales ratio} = \frac{NS - NV}{NS}$$

VALUES AT BREAK-EVEN POINT

$$\left.\begin{array}{c}\text{Ratio of break-even}\\ \text{volume to}\\ \text{present volume}\end{array}\right\} = \frac{\text{Fixed cost}}{\text{Fixed cost + Profit}}$$

or

$$R\ (\text{at break-even}) = \frac{F}{F + P} \quad [1]$$

$$\left.\begin{array}{c}\text{Sales volume}\\ \text{in units at}\\ \text{break-even point}\end{array}\right\} = \frac{\text{Fixed cost}}{\text{Difference between selling cost and variable cost per unit}}$$

or

$$\left.\begin{array}{c}\text{Unit sales}\\ \text{at}\\ \text{break-even}\end{array}\right\} = \frac{F}{S - V} \quad [2a]$$

$$\left.\begin{array}{c}\text{Sales volume}\\ \text{in units at}\\ \text{break-even point}\end{array}\right\} = \frac{\text{Fixed cost} \times \text{Present volume in units}}{\text{Fixed cost + Profit}}$$

or

$$\left.\begin{array}{c}\text{Unit sales}\\ \text{at}\\ \text{break-even}\end{array}\right\} = \frac{FN}{F + P} \quad [2b]$$

$$\left.\begin{array}{c}\text{Dollar-sales}\\ \text{volume at}\\ \text{break-even point}\end{array}\right\} = \text{Total dollar sales} - \frac{\text{Profit} \times \text{Total dollar sales}}{\text{Total dollar sales} - \text{Total variable costs}}$$

or

$$\left.\begin{array}{c}\text{Dollar sales}\\ \text{at break-even}\end{array}\right\} = NS - \frac{PNS}{NS - NV} \quad [3]$$

MORE ECONOMIC FACTS

By ALLEN W. RUCKER

THE EDDY-RUCKER-NICKELS COMPANY, CAMBRIDGE, MASS.

ONE CAN always expect Dr. Ennis to draw a clear and impartial picture and this event is no exception to that rule. I was particularly impressed with his description of the line of demarcation between the extreme rightist and leftist groups, and I was equally as much impressed by the rather complete exposition he has given of the opposing forces now operating in American economy. To that general and perspective view, I can perhaps add only two points of major significance.

COLLECTIVE GOVERNMENTAL ACTION OR VOLUNTARY COOPERATION

The first of these is that those of the left, who style themselves liberals, are in reality all those who believe that collective action of a people through its form of government can accomplish more toward economic progress than can the voluntary cooperation of those peoples through their forms of private enterprise. Conversely, the group of the right are generally those who believe that government should be kept within its sphere of the immediate past; protecting against external aggression, assuring internal law and order, and engaging only in those enterprises that long experience of the states has demonstrated can be better and more efficiently handled by government than by private enterprise.

Conflict between those opposing philosophies is not a conflict of left and right in reality or between liberals and reactionaries. For any review of history will make clear that the self-styled liberals of today were the autocrats, the dictators, and the monarchs of the past, and that it is they who are actually the reactionaries in the sense that they seek a return to politico-economic conditions prevailing in past centuries. On the other hand, the self-styled conservatives of the day are in a larger sense also reactionaries, in that they want what they imagine will be the fruits of liberal political government without paying its price.

This distinction may at first appear as fine as that difference between the philosopher and the specialist. The former is a man who knows little about a great many things and, by being progressive according to his ideas, comes to know less and less about more and more, until finally he knows nothing about everything. The specialist, on the contrary, is a man who knows considerable about little and, by following his ideas of progressiveness, comes to learn more and more about less and less until eventually he knows everything about nothing.

Self-styled liberals of today want government to do more and more about more and more until it does everything about everything. If we believe the conservatives, they would have government do less and less about less and less until after a while it does nothing about anything. Of course, the fact of the matter is that both groups want exactly the same thing, protection of a price structure that will guarantee rewards of economic activity without incurring any of the penalties.

Liberals propose to do this by making government responsible, by degrees, for all economic activities; and, when through poor judgment, greediness, or cupidity, their errors come back home to roost, compel it to pay for their mistakes. Labor, seeking a guaranteed and ever-increasing monetary wage rate, the farmer seeking a guaranteed and ever-increasing price for his crops, and the business man seeking relief from irritating and efficient competition, all join under this banner.

Conservatives propose to maintain present forms of government as now established under the Constitution, but many, if not most of them, wish to arrange so that government will support the bond market, or the commodity market, or public-works construction, or prices whenever those rates of exchange are endangered.

Mr. Rucker's scholarly and penetrating remarks constitute a new paper rather than a mere appendage to mine. They lead me to believe that, instead of being a middle-of-the roader, I am really in the right wing politically and in the left wing economically. I distrust the present expansion of governmental powers as I do all forms of price control, which have always been abhorrent to me. Mr. Rucker makes out a good case for the utter incompatibility of high production with price control. In drawing these deductions, he is pointing the way to a constructive program. He tells his story in the last four paragraphs, which should be read even if nothing else in his paper is read.

The December, 1937, number of *The National Geographic Magazine* has a picture showing the burning of heaps of coffee in Brazil. Comparable things have been done here. But "God is not mocked." The food we spoil we do not eat.—*William D. Ennis.*

PROTECTING AN ARTIFICIAL PRICE STRUCTURE

This brings me to my second point. Both groups are, especially the miscalled liberals who are radical in their economics and reactionary in their political philosophy, seeking by diverse means to protect an artificial price structure. It does not make the slightest difference which group wins, for the result will be the same; a vast inflation of governmental debt in an effort to sustain trade activity at distorted price relations or to keep goods and services off the market in an effort to protect a price level.

The philosophy behind the Wagner Act, the original NRA, the Walsh-Healy Act, and the Guffey Coal Act are exactly the same as the philosophy behind the original AAA and the forthcoming crop-control bill.

Crop-restriction measures of the past and present seek to sustain a price level by using government credit to restrict the farm output coming on the market. The various Federal and state wage laws seek to sustain a wage-rate level by using government power and credit to restrict the number of man-hours of labor coming on the market.

The end of crop control is seen in the lowest prices and the largest so-called surplus, a supply that will not bring the de-

[This discussion of "Forgotten Economic Facts," by William D. Ennis, which was published in MECHANICAL ENGINEERING, December, 1937, pp. 943–947, contains such interesting and thought-provoking comments that it is published as a separate article.—EDITOR.]

sired prices, because no such thing as a real surplus is possible when men in rags and tatters plow under cotton or when undernourished laborers with hungry children slaughter hogs and cattle. The end of crop control is seen in the ever-normal granary plan calling for upward of a billion dollars of fake money and credit. The same identical end will be seen in a huge new relief plan calling for upward of two billions of government fake money to finance keeping so-called surplus labor off the market.

The final end of all this foolish financing of the accumulation of crops, labor, homes, and what not will be exactly the same as the end of the British Rubber Pool, the Brazilian Coffee Pool, the Cuban Sugar Pool, and all the others, a disastrous collapse. Indeed, the greater the initial success of any price-stabilizing program, the greater the eventual destruction that will follow.

WORLD COMMODITY PRICES ARE NOT CONTROLLABLE

In my recent book, "Labor's Road to Plenty; the return to the American system of productivity," I made this forecast and I will repeat it here:

> World commodity prices are not to be controlled by the domestic monetary policies of one or more nations. The rise in farm prices during the past few years is, of course, merely temporary. These prices have been reacting to artificial curtailment superimposed upon unforeseen natural shortages. Soaring prices will ultimately bring the usual increase in world acreage and consequent bumper crops which depress prices. Agricultural prices will then resume the long-term trend downward to approximately the year 1950 which this writer suggested in 1930. Probably by midsummer 1938 or 1939, and perhaps by midsummer 1937, farm prices will resume their downward tendency. There is not enough credit in the United States or in the world now, any more than there was in 1925–1929, to halt that trend of farm prices. The ultimate outcome, however long postponed, will probably be somewhat as outlined below:
>
> At the first weakness in farm prices credit will be used to support trade at unbalanced price relationships thus opened up. It is this use of credit, i.e., to sustain the physical volume of trade at unbalanced prices that constitutes inflation and produces the final collapse. In so long as credit is used to support an expanding volume of production at parity prices, there is no real inflation—the credit extended is matched by corresponding values exchanged in the market. The moment, however, that credit is used to withhold goods coming on the market, i.e., to protect an arbitrary price structure, or to finance trading at disparity prices, or both, there is inflation. Whereupon this puts a strain upon credit and ultimately exhausts it. The trade supported by that credit promptly collapses and widespread deflation of inflated values follows. The use of private and government credit in the period 1925–1929 to sustain trade at distorted prices, and since 1930 to finance the withholding of goods and services from the market when they would not bring the prices asked, was probably the true cause of the subsequent collapse . . . as it will be of the one just ahead.

PRODUCTION AND PRICE CANNOT BOTH BE MAINTAINED

Both the self-styled liberals and the conservatives have contributed to that end by their agreement upon the one point that the price structure must be protected. What neither see is that total goods income of the nation when finally exchanged is a product of two variables, price and production, and that we have only two choices. We can protect price and allow production to go to any low level it may, or, we can maintain production and allow price to find its natural level. We can never protect both production and price and we never have.

We can shorten, if not indeed prevent, any serious depression by the simple process of allowing all rates of exchange, i.e., all prices, for goods, labor, securities, and what not to readjust themselves to their proper relations. Left alone, prices do this almost instantly and with little more than temporary damage. Meanwhile, production, and, of course, the employment needed therefore, can be maintained at almost normal levels.

On the other hand, if we choose to protect prices or what is more accurate, attempt to do so, production and employment inevitably suffer. The volume of goods produced and moving through the markets into consumption is curtailed, and unemployment, want, and distress follow. If we fail to abandon price control quickly enough, serious social disorders occur, leading finally to a change of the existing form of government either by ballot or bayonet, the suffering masses do not then care which.

This dreary prospect has repeatedly occurred in Europe from the same causes. It need not occur here and cannot, if you and all those whom you can influence can be taught to Let Prices Go Where They Will in order to sustain Production and Employment at High Levels. It is that simple and that complex. There are two alternatives. The nation is about to make its choice.

The true liberal will exert his influence to sustain production; the reactionary and the radical will seek to maintain a price structure; the former by using government credit without changing the form of government, the latter by changing the form of government to permit the more liberal use of credit.

If we ever needed middle-of-the-roaders, it is now. If we ever needed true liberals, it is now.

"NOON SIGHT," PHOTOGRAPH BY E. H. HULL SHOWN AT PHOTOGRAPHIC EXHIBITION AT 1937 ANNUAL MEETING

BRIEFING THE RECORD

Abstracts and Comments Based on Current Periodicals and Events

MATERIAL for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context, and credit to original sources is given.

Day by Day

ITEMS of interest in the news of the past month are principally concerned with engineers and honors that have come to them. Of major importance also is the report of the United States Maritime Commission, mentioned several times in this issue, and according to news from Washington, receiving serious attention at the special session of the Congress as these notes are written.

SHIPPING

On November 10, 1937, the United States Maritime Commission, Joseph P. Kennedy, chairman, issued its report to the Congress entitled "Economic Survey of the American Merchant Marine." The purpose of the survey was to establish a factual foundation for use of the Congress in dealing with the shipping problem. A distinguished group of experts contributed to the survey, and those working on it were instructed "to take nothing for granted, not even the desirability of having a merchant marine under the American flag."

Five major inquiries covering the entire maritime field were undertaken: (1) Should the United States attempt to compete in the international carrying trade? (2) What are the requirements of the United States? (3) What is the present status of the merchant marine? (4) What should be the policy of the United States? and (5) What will it cost to maintain an adequate merchant marine in foreign trade?

The conclusions of the study boil down the merchant-marine problem to three questions: What do we need? How can we get it? What will it cost?

The Commission finds that for the fullest development of our foreign commerce the United States needs to be represented in some 20 major trade areas, and that commercial shipping is a vital part of our facilities for defense. It believes that requirements for trade and for defense should be met, but not confused; expenditures for commercial purposes should be so designated; any additional expense incurred for defense should be earmarked. "The people have a right to know just where their money goes."

In regard to the question How can we get it? the Commission says in part:

The replacement requirements of American ship lines, in both domestic and foreign trade, are enormous. The total seagoing fleet, as of May 31, 1937, amounted to 1422 vessels of 2000 tons and over, aggregating 8,407,000 tons. Of this fleet a total of 1305 vessels of 7,402,000 tons, will be 20 years old or more by 1942. To replace all ships now approaching obsolescence would require the construction of an average of 261 vessels, of about 1,500,000 tons, per year. This staggering program would cost in the neighborhood of $2,500,000,000, an obviously impracticable expenditure even if shipyard facilities were adequate to the task.

The subsidized fleet, with which the Commission is directly concerned, consists at the moment of 155 vessels of 1,012,000 tons. Of this fleet 131 vessels, of 788,000 tons, will become 20 years old within the next five years. These vessels were built during the war period on the basis of prewar designs so that most of them are already obsolescent. Their excessive operating and repair costs are a drain alike upon the companies and upon the federal treasury. They must be replaced within the next few years.

A careful canvass of the resources of the subsidized lines indicates that there is little likelihood that they will be able to make needed replacements under present conditions. There is every indication, as a matter of fact, that some of the lines will not be able to survive. Of the 31 former mail-contract lines, seven have already been discontinued or are about to be discontinued; only nine are considered certain of survival in their present form.

These nine lines (plus one unsubsidized line) have indicated their willingness and ability to build a total of 65 vessels in the next five years. These plans are based upon so many contingencies, however, that the Commission is forced to point out that there is no assurance of a substantial volume of construction on the part of the subsidized lines. The Commission believes, nonetheless, that the lines should be given all possible encouragement consonant with the objective of the Merchant Marine Act, 1936. If they are still unable to build, the Commission should be prepared to proceed promptly with extensive construction for government account.

One of the chief difficulties of the American merchant marine has been our lack of a stable policy. That lack forced us during the World War into the mightiest shipbuilding program in history. That program in turn has now brought us face to face with the problem of replacing the majority of our vessels, both foreign-going and domestic, within the short space of a few years. The American merchant marine, unfortunately, was built as a unit; the American merchant marine, unfortunately, is about to obsolesce the same way.

Any plan that is adopted for the rehabilitation of the American merchant marine must take into account the deplorable situation with regard to labor. No matter how much is spent on subsidies, no matter how many new vessels are built, the effort will have been in vain unless something can be done to increase the efficiency of our crews and restore order on our ships.

For this reason, the Commission is constrained to recommend at this time the establishment of a mediation board similar to that provided by the Railway Labor Act. The Commission also has under consideration a program for the training of young men for a career at sea.

The Commission also recommends a revision of ship's articles. It has long been the practice of the sea to sign workers on and off for each voyage. Whatever justification there may have been for this archaic system in the days of the sailing ship,

there seems to be no reason for its perpetuation. Continuous employment is the rule in most industries. It should be the rule for shipping.

The final question in any discussion of the shipping problem is bound to be, What will it cost? The Commission has made an earnest endeavor to determine the probable cost of the merchant-marine program for the next few years. It is forced to conclude that the American people must be prepared to pay larger subsidies than those now provided if they are to maintain an efficient fleet in international trade.

Under the law the cost to the American taxpayer for the maintenance of the merchant marine is made up of three items —a construction differential, an operating differential, and countervailing subsidies.

The Commission believes that it will be extremely difficult, if not impossible, to determine differentials and foreign subsidies accurately. Everything possible is being done, and will continue to be done, to carry out the provisions of the law with respect to differentials. The Commission wishes the country to know, however, that this is not a scientific process and that only through periodic revision can subsidies be made to approximate the ideal of parity envisioned in the Merchant Marine Act.

Regardless of whether or not increased differentials can be justified mathematically, we are faced with the fact that the government will have to pay substantially higher subsidies than are now being paid. The temporary subsidies amount to about $10,000,000 a year. This money is divided among 17 lines. It appears that the number of lines will probably be reduced to about a dozen. Careful consideration of every factor involved indicates that the operating subsidies required to keep these lines in existence will probably average between $15,000,000 and $20,000,000 a year.

In addition, substantial payments will be required to subsidize construction. Here again it is difficult to arrive at better than a rough approximation of the actual cost, since the subsidies will depend upon the number of ships constructed and will vary with the fluctuation of American and foreign costs. If the lines should be able to build 65 vessels within the next five years, as has been suggested, this would involve an outlay of approximately $137,000,000. The Government's contribution would probably exceed $50,000,000 for the five-year period, or an annual charge of some $10,000,000.

It is evident, therefore, that the subsidies, both construction and operating, will aggregate from $25,000,000 to $30,000,000 a year. If the lines are unable to make needed replacements and the government is forced into an extensive building program, the amount will, of course, be substantially increased.

The Commission now has available funds aggregating $85,000,000. In addition Congress has authorized the expenditure of $115,000,000. This gives a total of $200,000,000 now available for the purpose of rehabilitating American shipping in foreign trade.

While the building program in hand and in immediate prospect (consisting of one large passenger ship, 10 or 12 tankers, and 8 or 10 cargo vessels) is a modest one, it should prove sufficient to form a reasonable backlog of construction for shipbuilding plants. This should in turn be very helpful in employing and keeping employed, skilled and unskilled labor in the shipbuilding industry, not only in the plants of the shipbuilding contractors but also in the plants of subcontractors throughout the country.

By the same token this program should be an incentive to the shipbuilding industry to increase productivity, improve efficiency, and reduce the price structure.

MICROFILM

At the Book Fair, held in New York City during the fall of 1937, the observing editor of *The Saturday Review of Literature* noted two books photographed on microfilm and projected on mirrors or ground-glass screens, and wondered editorially in his issue of November 20 whether any of the publishers had really meditated on them.

Now the microfilm, as the general public is beginning to learn, is the microphotographic duplication of a typewritten or printed page on a frame of a 35-mm motion-picture film. Many uses of it have been made, prominent among them being that employed by the Bibliofilm Service of the Documentation Division of Science Service. By means of it rare manuscripts and documents can be photographed for use of students, entire books and libraries can be reduced to a small compass of a few feet of film at a small cost, and many publication services intermediate between the typed manuscript and the printed volume can be provided for. With a reading machine to magnify the tiny film, the copied typescript or book page can be made as readable as the original.

Our issue of July, 1937, page 561, told, for example, how the microfilm method is being used by the Engineering Societies Library to copy all of the library's catalog cards for 151,512 volumes, maps, and searches at a cost of about $400, as an inexpensive insurance against loss of the original cards by fire. The Committee on Publications of The American Society of Mechanical Engineers has given thought to ways in which it might use the microfilm method in its costly printing program, but as yet has not adopted it. The method is in its infancy, but its use will undoubtedly have a rapid growth.

Says the editorial in the *Saturday Review* already referred to:

> The revolution has come so quietly that few people realize how much headway it has made. Books on microfilm are only a part of it, but they alone have already dissolved away part of the publishing system and have extended a system of their own into areas that the publishers have never reached. Departments of the government, business and industrial organizations, and research foundations are now making and circulating books on film, books which have not received or needed the services of a publisher, books which have not even been to a printer's shop. Libraries are storing a year's file of a daily newspaper in a couple of cubic feet and are making their rarities available to one another at no risk and a few cents' charge. Scholars on a month's vacation are photographing more books than they could formerly have consulted in a sabbatical year and taking them home to use at their convenience.
>
> Once a book has been photographed it will never go out of print. The problem of the small reprint edition has thus been solved for all time. This path to this solution has unexpectedly solved other problems as well. The apartment dweller can now keep five hundred volumes in the drawer of a radio cabinet. The student or the aspirant to culture can buy a library en bloc for four or five hundred dollars.
>
> The revolution makes headway too by other means than film. The problem of the small original edition need trouble the scholar or the specialist no longer. A dozen processes now in use make it feasible for the twelve people who understand Einstein to produce books exclusively for one another at trifling cost, and for the program chairman of the Home Culture Guild to distribute her poems and fragments of her novel among her admiring friends. The amateur author and the semi-pro have been set loose in a happier world.
>
> It may be that when the *Times* stages its fair in 1975, or even 1950, and we sit comfortably at home viewing it on our television screen, prominent among the exhibits we shall see, mounted between a dodo and a heath hen, the mummy of a well-dressed and bewildered-looking man labeled "Publisher." At any rate, in November, 1937, it would be a good idea for every publisher to supply himself with a copy of Robert C. Binkley's "Manual on Methods of Reproducing Research Materials" (Ann Arbor: Edwards Brothers, Inc. Produced by photolithography), take it home, read it, and fast and pray. For the cloud grows, and if you were to go out on the avenue and yell "Get a horse!" the joke wouldn't be on the automobile.

A.S.A.

At a luncheon at the Hotel Astor, New York, N. Y., on Dec. 1, 1937, in connection with the annual meeting of the American Standards Association, Dana D. Barnum, past-president, American Gas Association, was reelected president of the organization.

Speaking at the luncheon on "Thirty Years of Standardization in Retrospect," Frank B. Jewett, vice-president, American Telephone and Telegraph Company and of the Bell System Laboratories, said that his distrust of the government as a maker of standards was more basic than fear of intrusion of political factors. Said he:

They reside (1) in the belief that the agencies of government, circumscribed as they are of necessity by the restraints of government, are not in the best position to obtain and appraise all the facts; and (2) that being agencies of the government anything they emit tends to appear more important than it really is and more difficult to abandon or modify.

In other words, standards made by government are, it seems to me, more likely to become instruments of restraint of progress than are those emanating from a mobile body like the American Standards Association.

When to this is added the almost inevitable tendency that develops in men clothed with apparent authority to exercise it punitively it seems to me that the case for voluntary association in the field of standardization is substantially ironclad.

This should not be construed as a belief that government should be excluded from the making of standards. Government should participate largely but on the same voluntary basis as the other members of the association. It is usually a plausible tale that Uncle Sam takes on part or all of this standardizing job because he can do it so much better or so much faster. It has only one demerit, that it is not true.

F. M. Farmer, chairman of the Standards Council, reported that 59 standards had been set up during the year, of which 28 were new and the remainder revisions.

Other officers elected were E. A. Prentis, vice-president, F. M. Farmer, chairman of the Standards Council, and R. P. Anderson, vice-president. At a meeting of the board, P. G. Agnew, secretary of the association, was named as official representative of the A.S.A. on the council of the International Standards Association.

ECONOMY

Several papers presented at the 1937 annual meeting of the Society of Naval Architects and Marine Engineers, held in New York City, Nov. 17 to 19, 1937, have been abstracted in this and in last month's issue. Another paper, by W. W. Smith, chief engineer, Federal Shipbuilding and Dry Dock Company, Kearny, N. J., contained the following table in which operating results of the *Normandie* are compared with those of the Grace Line geared-turbine ships of the *Santa Rosa* class.

	Normandie	*Santa Rosa*
Shaft horsepower, main engines	160,000	13,000
Shaft horsepower on one screw	40,000	6,500
Steam pressure, lb per sq in.	400	400
Steam temperature, F	680	750
Fuel rate in pounds per shaft horsepower per hour for all purposes	0.69	0.63
Heat consumption in British thermal units per shaft horsepower per hour	12,765	11,655
Thermal efficiency for all purposes, per cent	19.9	21.8

SCIENCE

According to an announcement in the October 29 issue of *Science*, signed by six members of the Encyclopedia Committee of Organization, recent years have witnessed a striking growth of interest in the scientific enterprise as a whole and especially in the unity of science. A science of science is appearing. This is an indispensable corrective of the extreme specialization of scientific research. It is an urgent task of science to work out the synthesis of its results and methods. Otherwise science will not have carried to its limit the fulfillment of its own task as science, nor will it perform adequately its educational rôle in the modern world.

The unity of science movement, it is said, has found an organized contemporary expression in the International Congresses for the Unity of Science. Three such congresses have been held, and preparations are now being made for a congress to be held at Harvard University from Sept. 5 to 10, 1939.

For some time it has been felt that a systematic expression of the point of view and results of the unity of science movement was necessary. This need has led to the development of a plan for the publication of an "International Encyclopedia of Unified Science." The general purpose of this work is to bring together material pertaining to the scientific enterprise as a whole. Its task, it is claimed, will not be to present the detailed results of the special sciences but rather to stress the logical structure of the special sciences considered in relation to one another. The encyclopedia will therefore be concerned with the developments of a unified scientific language; with problems concerning the logical analysis of, and correlations between, concepts and fundamental principles of the various sciences; with questions of scientific procedure; and with the various senses in which science may be considered a unified whole. Treatment of these fundamental matters will be supplemented by presentations of the history of scientific thought, the sociology of science, the newer logical techniques, and the general theory of signs. It is planned to show explicitly gaps in the system of knowledge and questions which still remain open; where agreement has not been reached, divergent opinions will be presented side by side.

The subjects chosen according to the announcement, will insure that the total series of contributions will form a systematic whole dealing with all the main fields of science and with all the types of consideration which the existence of science provokes. The monographs will be intelligible to the person of a scientific habit of mind interested in the whole range of science. The encyclopedia is not designed to popularize science or to compete with the existing type of scientific encyclopedia. It is believed that the general educational implications of the unit of science movement are important, but the immediate aim of the proposed work is rather to reach those persons upon whom the future of science depends and to stress those matters which existing encyclopedias of science neglect.

As a means of launching the project of an "International Encyclopedia of Unified Science," there is to be published by the University of Chicago Press a series of short monographs or pamphlets, twenty in number, which will serve as introductions to all the main fields which are to be represented in the Encyclopedia. This series of pamphlets taken as a whole will constitute the first two introductory volumes of the encyclopedia, but will be issued as an independent and completely self-contained unit under the title of "Foundations of the Unity of Science."

WELDING

On November 3, 1937, the city of Chicago approved a revision of the city's building code to permit the use of welding in structural work. A few months ago (see our issue of September, 1937, page 689) New York City revised its code also to permit welding, effective Jan. 1, 1938.

DOW

Word has been received that on Nov. 19, 1937, Alex Dow, past-president and honorary member, The American Society of

Mechanical Engineers, and president, The Detroit Edison Company, was elected an honorary life member of The Institution of Mechanical Engineers (Great Britain). This well-deserved recognition of one of the most distinguished and influential engineers of this country will be heartily applauded on both sides of the Atlantic.

Few if any of the surviving pioneers of the electric light and power industry have served as brilliantly in an executive capacity as has Mr. Dow. He has made his mark as financier, administrator, executive, accountant, salesman, engineer, and inventor. Occupying an almost unique position in the industry, his boldness and foresight have maintained for him a leadership typical of pioneers by nature and instinct and representative of the best that this industry has developed. At a time when alternating current was in its infancy he was led to choose a 60-cycle current before frequency had become standardized. At an early date he used the 24,000-volt cable. When 750-hp units were generally found in boilerhouses he installed a steam boiler of 2350 hp and thus became "father" of the "big" boiler. He was first to adopt the underfeed stoker for large boiler units. Much of the early developmental work in this type of boiler was done in his plants, and the literature of the A.S.M.E. is rich in contributions that have come from engineers in his employ. His research organization has an international reputation. He pioneered in the use of steam at high temperatures. With his rare combination of engineering sense and skill, administrative ability, and financial genius his efforts have directed all departments of his organization. Possessing a keen sense of the importance of public relations, he pioneered in rate making to the benefit of the industry and the public he serves.

Born in Glasgow, Scotland, the son of an accountant, and with an education limited to Scottish Presbyterian parish and board schools, he had an ambition to become a marine engineer, and at the age of 12 years went to work as a messenger in a railway office. Following a period of clerkship in the Cunard Steamship Company, he came to the United States in 1882 at the age of 20 in the employ of the Baltimore and Ohio Railroad, and from 1888 to 1893 served as district engineer of the Brush Electric Company, Chicago, Ill. From 1893 to 1896 he built the first public lighting plant for the City of Detroit, and in the latter year became vice-president of the Detroit Edison Company, being elevated to the presidency in 1912.

In presenting Mr. Dow for honorary membership in the A.S.M.E. at the Detroit Meeting of the Society in May, 1937, Harvey N. Davis said:

"There is something intimate about conferring honorary membership on a man, something that makes him peculiarly one of us, something that is appropriate particularly to a man whose personality has caused all of us, both to admire and to love him through the years."

Mr. Dow *is* universally admired and loved. Whenever he speaks, men listen, both because of what he says and the manner in which he says it. He expresses a sound and kindly philosophy with wit and simplicity. At Detroit, in presenting Henry Ford, formerly a fellow employee, for the Holley Medal he said, "One of the things that I find it difficult to teach to engineers was learned by me long before those days: When you have a first-class man who can swing a job, let him alone. I let Mr. Ford very much alone." And, on the subject of wages, he said, "He [Mr. Ford] and I argued for weeks as to what was the proper pay to secure proper services in our engine room of that day. . . . . .I talked dollars and cents; Henry stuck to one principle, and I commend it to you: The proper pay for a permanent force is the pay that will let a man marry and bring up a family decently."

As recently as November, 1937, at a forum of the Investment Bankers Association, when Frank R. McMinch, former chairman of the Federal Power Commission, expressed increased confidence in the future of private power companies, Mr. Dow, reviewing experiences that scarcely justified such confidence, represented himself as a "puzzled manager but not a fearful one." To be puzzled is probably the greatest concession Mr. Dow has ever made in the face of a situation he could not control. Not to be fearful is his manner of meeting it.

HOVGAARD

Among those presenting papers at the 1937 Annual Meeting of The American Society of Mechanical Engineers was William Hovgaard, member, professor emeritus of naval design, Massachusetts Institute of Technology, and former officer in the Royal Danish Navy. In celebration of Doctor Hovgaard's eightieth birthday, on Nov. 27, 1937, a luncheon was held at the Hotel Astor, New York, N. Y., sponsored by the American Society of Danish Engineers, the Danish Officers Club, and the Danish Luncheon Club. Doctor Hovgaard has long been considered an expert on naval design. In 1917 he received the Gold Medal of the British Institution of Naval Architects for a paper on submarine boats. He has written extensively on submarines and on warships. His recent contributions to the A.S.M.E. have dealt with the mechanics of steam pipe lines and bends. He came to this country in 1901 as a member of the faculty of M.I.T. and retired from active teaching in 1933. His service with the Royal Danish Navy covered the period from 1882 to 1901, with the exception of two years, 1895 to 1897, spent with Burmeister and Wain, of Copenhagen.

DAVIDSON

K. S. M. Davidson, Stevens Institute of Technology, member, A.S.M.E., was awarded the Captain J. H. Linnard Prize at the conclusion of the discussion of technical papers before the Society of Naval Architects and Marine Engineers, Nov. 19, 1937. The prize was given for Professor Davidson's paper which was entitled "Some Experimental Studies of the Sailing Yacht," read before the society at the 1936 annual meeting. Professor Davidson's studies on this subject influenced to a considerable extent the success of the design of the American cup defender *Ranger* in the races held with the British yacht *Endeavor II* off Newport this year. Professor Davidson has been assistant professor of mechanical engineering since 1930 and director of the experimental towing tank at the Stevens Institute of Technology since 1935.

BEDAUX

Among other commentators, George E. Sokolsky, in one of his Monday morning contributions to the *New York Herald-Tribune*, has called attention to the French management engineer, Charles Bedaux, who received so much newspaper publicity during the fall of 1937. What Sokolsky tried to do was to untangle in the mind of the public the time-study system for which Mr. Bedaux is well known and his relationship with the Duke of Windsor.

The word "speed-up," says Mr. Sokolsky, is a smear word like reactionary or Fascist, and he doesn't like smear words. Getting away from smear words and down to essentials, he said that it is essential in mass production to determine labor costs. If time studies were not worked out, he continued, it would be altogether impossible to know what is takes to make, let us say, a pound of steel or an automobile. Even if an annual wage were paid the workers, he pointed out, it would still be necessary to know exactly how many units of a commodity would be produced for the total pay roll, or no price could be fixed.

Of course, Mr. Sokolsky hastened to add, all systems of time

studies lend themselves to vicious abuses, but, he explained, the fact that some employers are gyp artists does not mean that time studies should be thrown out of the window. He even ventured to prophesy that the day will come when leading unions in mass-production industries will employ engineers to prepare time studies and measured work charts for them, and that union engineers and employer engineers and outside consultants will come to terms on a scientific basis satisfactory to all parties.

In 1929, Charles W. Lytle published in MECHANICAL ENGINEERING (page 493) a paper entitled "Wage Incentives for Direct Labor," in which many schemes, including the Bedaux system, were graphically set forth, described, and compared.

DOHERTY

Henry L. Doherty, member A.S.M.E., president of the Cities Service Company, has been awarded the Anthony F. Lucas Gold medal of the American Institute of Mining and Metallurgical Engineers for distinguished service in improving the practice of finding and producing petroleum.

SOMMERMAN

To G. M. L. Sommerman, for his paper "Properties of Saturants for Paper-Insulated Cables," published in *Electrical Engineering*, May, 1937, has been awarded the Alfred Noble Prize for 1938. The Alfred Noble Prize is awarded by a committee of representatives of the four Founder Societies and the Western Society of Engineers.

ANNIVERSARY

An attractive booklet, recently issued, commemorates fifty years of service of the R. K. LeBlond Machine Tool Co., of Cincinnati, Ohio, makers of lathes and other machine tools. Entitled "What Makes Main Street," the booklet shows that "the lathe was the service tool on which all other tools had their beginning," and describes the LeBlond lathe of today.

Richard K. LeBlond, president of the company, has been a member of The American Society of Mechanical Engineers since 1900. Among the references given by Mr. LeBlond on his application for membership in 1900 were names of some men well-known in the machine-tool industry: Wm. Lodge, one of the founders in 1892 of Lodge and Shipley; W. E. Hall, at that time assistant general manager of the Niles Tool Works, Hamilton, Ohio; and H. M. Norris, then works manager, Bickford Drill and Tool Company, forerunner of the Cincinnati Bickford Tool Company. Mr. LeBlond's son, Richard E. LeBlond, is also a member of the Society.

COFFIN

On Nov. 21, at Sea Island, Ga., Howard Earle Coffin, member, The American Society of Mechanical Engineers, engineer, industrialist, chairman of the board, Southeastern Cottons, Inc., and former vice-president, Hudson Motor Company, died of a presumably accidental bullet wound. He was 64 years old.

Mr. Coffin entered the automobile industry in 1902 in the employ of the Olds Motor Works, Detroit, following graduation from the University of Michigan in 1896, as engineer in charge of the experimental shops. In 1906 he resigned as chief engineer of the Olds company to become chief engineer and vice-president, E. R. Thomas-Detroit Company, which later became the Chalmers-Detroit Motor Company. In 1910 he was appointed vice-president and chief engineer of the Hudson Motor Car Company, a position he held until 1930.

In 1916 Mr. Coffin was appointed by President Wilson chairman of the Committee on Industrial Relations and, with the aid of the National Engineering Societies, made a census of the country's industrial resources. During the World War Mr. Coffin served as chairman of the United States Aircraft Board, as a member of the advisory commission, council of National Defense, the Naval Consulting Board, the Aircraft Production Board of the United States, and the American Aviation Mission. He is credited with development of the Liberty motor.

After the war Mr. Coffin became one of the founders and first president of the National Air Transport, Inc., and in 1928 chairman of the board, a position he held until 1930.

In 1925, when Herbert Hoover, then Secretary of Commerce, suggested that the American Engineering Council undertake a survey of civil aviation, it was through the generosity of Mr. Coffin that funds were made available for the work. The report, published in 1926, during the presidency of James Hartness, past-president and honorary member, A.S.M.E., was prepared by a Joint Committee of Civil Aviation of the U. S. Department of Commerce and the American Engineering Council, of which J. W. Roe, member, A.S.M.E., was vice-chairman and director.

In 1911 Mr. Coffin purchased Sapeloe Island, off the coast of Georgia. He was active in the development of Sea Island Beach and was chairman of the board of the Sea Island Company at the time of his death. In 1932 he bought into the Hunter Manufacture and Commission Company, one of the largest textile-selling organizations in the world, which he helped to liquidate, and became one of the founders of Southeastern Cottons, Inc., which he served as chairman of the board at the time of his death.

La Mont Boiler

THE STEAM ENGINEER

ACCORDING to an article in the November, 1937, issue of *The Steam Engineer*, the largest La Mont boiler in the world is to be installed in the Deptford West Power Station of the London Power Co., Ltd. The La Mont boiler is of the forced-circulation type, well known and widely adopted in Europe. The new unit is the largest La Mont boiler in the world, being designed for an evaporation of 350,000 lb per hr at a working pressure of 375 lb per sq in. Initial arrangements are to provide a steam temperature of 780 F, and provision is made to increase the temperature to 850 F at a later date.

The special feature of the La Mont steam generator is that it combines forced circulation of the water with controlled distribution of the water to the individual boiler tubes. The natural circulation is replaced by forced circulation by means of a pump. The boiler water passes from the boiler drum into the suction side of the circulating pump supplying the differential pressure required to overcome the friction loss in the boiler circuit. This friction loss includes that caused by the orifices situated in the tube inlets. These orifices with which each boiler tube is equipped serve the purpose of apportioning the water supply to the tubes in accordance with the heat absorption of each tube.

As a rule, the water circulation through the individual boiler tube is so adjusted by proper dimensioning of the orifice that at normal boiler load each tube receives eight times as much water as steam generated in the tube. By this ratio, high velocities of the steam-water mixture in the boiler tubing are insured at all loads so that overheating of the tubes is made impossible even under the most severe conditions.

The steam-water mixture issuing from the boiler tubing is discharged into the boiler drum, where water and steam are

separated. While the steam is drawn off into the superheater, an equivalent quantity of feedwater is supplied to the boiler circuit by the feedwater pump.

As an illustration of the saving in space to be effected, it is interesting to note that the Deptford boiler is being installed in a bay similar to that in which, a few years ago, natural-circulation boilers of only about one-third capacity were installed.

The boiler is generally formed of $1^{1}/_{2}$-in. O.D. cold-drawn mild-steel tubing, the tube lengths being bent to form in a

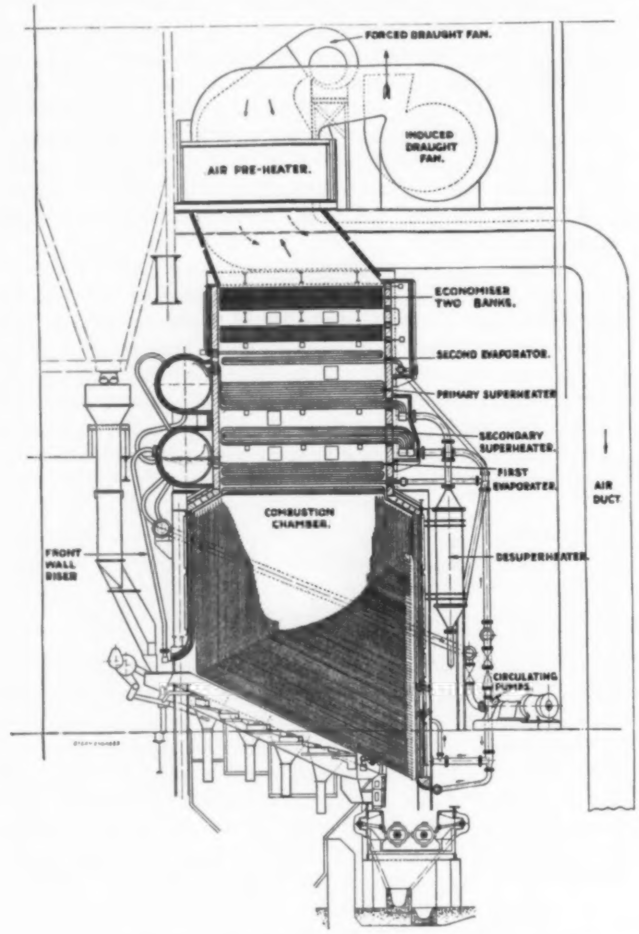


FIG. 1 VERTICAL CROSS SECTION OF LA MONT BOILER INSTALLATION

special bending machine, the lengths welded together by the oxyacetylene process, special precautions being taken by the manufacturers to prevent oxidation during welding and to prevent droplets or fissures in the bore of the tubes, a perfectly smooth bore being desirable throughout.

The combustion chamber is entirely lined with close-pitched tubes forming waterwalls on all sides of La Mont construction. The tubes forming the waterwalls are adequately supported and spaced and are backed by suitable refractory and insulating material.

By reason of the forced circulation, the tubes forming the boiler heating surface can be arranged at any angle, and in a manner best suited to obtain the highest heat transfer. It will be noted from Fig. 1 that the heating surfaces forming first evaporator, the superheaters, second evaporator, and the economizer are all arranged in horizontal banks, the tubes being in staggered formation, the gas in cross flow to form an ideal system for heat transfer by convection, and further the gas flow is a single pass throughout the boiler, resulting in the most economic use of induced draft.

The power saved on draft losses through such a unit is claimed to more than compensate for the power absorbed by the water-circulating pumps. Two of the circulating pumps will be electric-motor-driven, the third pump being steam-turbine-driven. Automatic change-over apparatus will be provided to change over from one pump to the other in the event of failure of the working pump, together with a complete equipment of protective devices to meet the special requirements of such a large important unit.

Slag in Boiler Furnaces

AMERICAN CERAMIC SOCIETY

BEFORE the refractories division of the American Ceramic Society, on Sept. 3, 1937, E. G. Bailey, member A.S.M.E., presented a paper entitled "The Action of Slag From Fuel in Boiler Furnaces," in which he reviewed the history of the development of steam-boiler furnaces with respect to the action on them of slag.

Mr. Bailey showed that much greater latitude can be taken in the design and operation of steam-boiler furnaces than with furnaces used in metallurgical and ceramic processes because exact temperature is not required in steam-boiler furnaces, wide variations in rates of combustion are needed to meet steam-output demands, and water cooling may be used without increasing the total fuel consumption or reducing the efficiency.

These factors lead, he said, to the possible use of a wide variety of fuels, and often low-grade fuels are the most economical on a cost-performance basis. Inasmuch as most kinds of fuel contain ash, and as the ash usually forms slag, slag is one of the most important factors controlling the design and operation of furnaces. Slag, he said, usually attacks refractory furnace linings; it tends to foul the furnace and the boiler heating surface and to clog gas passages.

The efficient burning of fuel involves high temperatures and turbulence, both of which, carried to extremes, will reduce the life of almost any refractory near the active combustion zone even though there is no ash or slag in the fuel.

The presence of ash from the burning fuel usually lowers the temperature at which the furnace can be operated without undue deterioration of the refractory. The ash from many coals, even high-grade low-ash coal, forms an eutectic with a melting point so low that no satisfactory operation can be obtained with any known refractory unless it is cooled in some manner.

Early efforts at cooling consisted in circulating the air for combustion on the outside of, or by actually flowing into, the furnace through perforations in the refractory blocks. In fact, all air-cooled walls leak a considerable quantity of air into the furnace, and it is this leakage which aids more in the maintenance of the refractory than the actual conduction through the refractory itself except in the case of those having a high thermal conductivity.

Water cooling of the refractory in boiler furnaces about 15 years ago consisted of tubes spaced on 9- to 18-in. centers arranged in front of the walls. The water tubes formed a part of the boiler system and therefore all heat was utilized. This construction like air cooling added only a relatively small increment to the rate of combustion, beyond which the refractory wasted away by fluxing or spalling in the hotter parts of the furnace and formed a foothold for the building of slag in the

cooler parts of the large furnaces which were the order of the day.

Some designers of water-cooled construction then went to the extreme of using closely spaced tubes or tubes with metal fins. Others used a refractory tile cooled directly by tubes or tile cast into iron blocks tightly clamped to reasonably spaced water-cooled tubes. Later constructions consist of metal studs welded to the tubes and to which plastic refractory is applied, forming a complete facing of refractory which withstands flame impingement and washing by molten slag of the most vicious constituency. In the zones of the furnace where ash is removed dry or semidry, smooth cast-iron blocks or bare tubes serve to chill the slag and prevent its building out and choking the discharge opening.

Combustion efficiency and capacity are best attained in hot furnaces, hence the use of refractory-coated water cooling, resulting in furnace temperatures up to 2900 to 3150 F near the burners. Slag-tap furnaces result in high ash recovery as it collects on the walls. High temperatures are conducive to complete combustion in the furnace near the burners; the gases are then cooled by bare waterwalls before they enter the tube bank where gases and fly ash are below the sticky temperature. Refractory walls and insulating brick surround the boiler tubes and the superheater and economizer beyond.

Mr. Bailey, with numerous illustrations, traced the developments in the design of boiler furnaces from the early boilers of the Lancashire, Cornish, and Scotch types to modern steam-generating units, and included references to the effects of the introduction of pulverized coal. In a summary he said:

Many small boilers burning fuel with stokers, as well as oil or gas, continue to use reasonably sized refractory furnaces to a great extent. The larger boilers for industrial use, as well as central stations, have adapted pretty generally water-cooled furnaces of one kind or another in a greater or less degree, depending upon the nature of the ash, the economics of high rating, and many other factors.

In certain districts the trend is to burn natural gas or oil if it is the most efficient fuel, but where coal is the economic fuel the trend is toward using it more in pulverized form than with stokers.

Properly applied water cooling adds to the reliability of the furnace, reducing maintenance and outage charges, and enables a greater degree of variation in load at higher ratings in so far as the furnace walls themselves are concerned. Water cooling properly applied assists in the discharge of ash from the furnace, whether dry, semidry, or slag tap.

Cooling of the gases after they leave the combustion zone is essential to prevent slagging and clogging of the boiler tube banks and the resulting extended reduction in areas of gas passages and restriction of steam output. The adding of water cooling to generating units usually reduces the total cost, increases the over-all efficiency, and with certain forms of water cooling reduces the weight and space required.

With better burning equipment and water-cooled walls, smaller furnaces can be used, thereby making a large saving in space, weight, and cost.

In industrial plants where waste fuels are burned in conjunction with base fuels a serious refractory problem is avoided by use of proper water cooling.

Water cooling should be surfaced with suitable refractory in the high-temperature combustion zone with all fuels, and it is absolutely essential with certain low-grade fuels which cannot be burned in a furnace with too low a temperature.

Water cooling can be adapted to a steam-generating unit without increasing the total fuel required for a given steam output and is in the direction of increased thermal efficiency.

Fire Control for Ships

THE SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS

DISASTER caused by fire at sea and the much discussed program of the Maritime Commission justify consideration of a paper on "Fire Control for Passenger Vessels," by George G. Sharp, presented at the 1937 annual meeting of The Society of Naval Architects and Marine Engineers. The paper is supplemented by a report of fire tests on the steamship *Nantasket* by a group, of which the author of the paper was chairman, set up by the Subcommittee, to the Senate Committee on Commerce, on Safety of Life at Sea. This group was known as the Subcommittee on Fire Control.

The paper is too extensive and the reports of the tests are too detailed to be adequately abstracted, but the following paragraphs quoted from the paper present a résumé of the results.

As noted in the report of the tests on the steamship *Nantasket*, this vessel was assigned to the committee with a small fund to carry out such tests as were deemed necessary. A group of enclosures was constructed, in various sizes (11 by 9 ft, 11 by 12 ft, 11 by 18 ft, and 11 by 27 ft) and of various materials. A careful check was made of the amount of combustibles which enter into the passenger effects and furnishings of an average stateroom, and this was found to approximate five pounds per square foot of floor area closely enough to justify the use of this figure in the fueling of the rooms for test purposes. A number of tests were conducted, all details of which are dealt with in the report.

The results of these tests gave further demonstration of the necessity for making each unit intact with the structure of the ship. It was found, moreover, that several of the panel types previously thought to have very effective fire-resisting qualities were not satisfactory once the general temperature of the test enclosure began to rise; the objection being, generally, that combustible or impregnated cores caused a hazardous smoke and flame condition no matter what protection they had been given in the form of veneers. As the testing program progressed, it was impossible to avoid the conclusion that the only sound method of controlling the fire hazard was through the use of panels having incombustible cores, in connection with an assembly system designed for both strength and incombustibility. It was further demonstrated that, given incombustible cores, no particular hazard was presented by the use of face veneers of wood or other combustible materials, and, further, that an appreciable quantity of combustible face trim might safely be used with or without combustible veneers on panels.

Given the conditions of intactness and integrity in cabin construction, it was found that the time required to reach a stateroom fire was no longer a matter of such great importance, inasmuch as the combustible contents of the enclosure could be completely consumed during the period of its integrity even with the porthole uncovered and the door open enough to provide considerable draft. On the other hand, in cases where panels with combustible cores were used, the structure itself was afire before 50 per cent of the combustible contents was consumed—a condition which, under ordinary shipboard circumstances, would not only interfere materially with movement in adjacent corridors for either fire-fighting or escape purposes, but encourage the development of a small fire into such a ship-wide conflagration as swept the *Morro Castle*.

It will be seen, therefore, that the experience from the *Nantasket* tests further developed and substantiated the necessity for the two essentials of intactness and integrity in stateroom construction, the latter comprising the two supplementary factors of bulkhead panels, with incombustible cores, fitted into an

assembly system embodying both strength and incombustibility. The suitability of several available panel types was demonstrated, in conjunction with two satisfactory systems of erection. Other panel types and assembly systems will no doubt be developed as the demand grows and manufacturers' research departments give additional attention to the matter. It would appear entirely possible that new developments and increased production volume will ultimately create a situation in which fireproof construction methods will be more economical than existing methods, both financially and from the standpoint of time.

Superliners and Aircraft

UNITED STATES MARITIME COMMISSION

ESPECIAL interest is attached to those sections of the report of the United States Maritime Commission, "Economic Survey of American Merchant Marine," which deal with superliners and aircraft. The following passages are quoted from this report.

The advisability of building superliners has been studied in great detail. It is the opinion of the Commission that the United States should not attempt to compete in the luxury-liner field. This type of vessel is believed to be economically unsound. The excessive investment, extreme variations in seasonal business, speedy obsolescence, and the added cost of securing extra speed all point to an unnecessarily high cost of transportation. The building of these vessels, at the expense of other more economical ships, cannot be justified by the United States.

Instead of superliners, the American contribution to North Atlantic travel should be fireproof, vibrationless, attractive, and economical vessels of reasonable size and speed, distinguished by the utmost in safety and comfort, suitable for business or pleasure travel, available for national defense, and manned by competent, resourceful, and disciplined personnel.

The claim has been made that very large vessels are necessary from the point of view of national defense. This appears to be erroneous. The Navy would prefer two or three of the *Manhattan* type of vessel to one of the superliner type. The superliner offers a much larger target for airplanes and submarines and cannot enter the majority of harbors. The number of drydocks in the world for such vessels is extremely limited and docking costs are enormous. Another limitation occurs if the vessel is unable to transit the Panama Canal. Consequently, such vessels are not considered desirable from a national-defense standpoint.

While there are no technical obstacles to the designing, building, and operation of supervessels, and while they can be made just as safe as smaller vessels, there seems to be little advantage in spending enormous sums on one great ship. Moreover, there is not enough marine insurance in the world to cover this type of vessel.

Finally, future developments in the realm of fast service appear to be in the air rather than in the building of extravagant superliners.

Transoceanic aviation looms as an important competitor of express passenger vessels of the superliner type, as will be shown by a forthcoming report of the Commission to Congress. Flying boats, carrying 40 to 50 passengers, capable of crossing the Atlantic Ocean on a nonstop flight in 20 hours, and with transportation costs under those of the superliners of today, appear to be a reality in the near future.

To determine the probable effect of transoceanic aircraft on shipping, a comparison has been made between the superliner and aircraft—designed and likely to be developed in the near future—on the basis of reliability and safety, comfort, costs, and traffic loads. Except for some possible loss of mail revenue, it is not believed that aircraft will injure to any appreciable extent the types of passenger vessels recommended for the American merchant marine, which do not include superliners. Aviation obviously will have no effect in so far as freight vessels are concerned.

The reliability of aircraft, and their ability to maintain schedules, have become increasingly impressive. The problem of safe transoceanic aviation is essentially one of range and size of craft. Actual design and construction technique appear to offer in the immediate future several 120,000-pound flying boats of 5000-mile nonstop range, carrying 40 to 50 passengers at an average speed of 175 miles per hour. This nonstop range completely changes the possibilities of transoceanic flying, as weather hazards and delays are greatly reduced. Instrument flying and radio are conquering fog, and thunderstorms have become ineffective commonplaces to fast aircraft.

Comfort in the air is making enormous strides, with large flying boats rapidly approaching the remarkable smoothness of the dirigible. Both types are designed to be equipped with lounges, dining saloons, and other features ample for the short period they are in use.

The cost of passenger transportation over the oceans is likely to be less on future aircraft than on superliners. This conclusion is arrived at by a comparison of the costs of depreciation, fuel, and crew for the superliner and both types of aircraft—the flying boat and the dirigible. Aircraft designs now available for immediate construction would enable a fleet of 18 flying boats, on a daily service of three planes a day, to offer the same total passenger capacity per year as a superliner, at a production cost for building the planes estimated at $18,000,000 against an American production cost of $50,000,000 for the superliner.

Most astonishing is the power used per passenger crossing. In the total expenditure of power for the number of hours used is found an indication of the cost of machinery and hull and of operating personnel that is properly attributable to each passenger. The superliner requires four or five times as many horsepower-hours per passenger as does the flying boat.

In comparing replacement costs, the superliner is depreciated on a straight 20-year basis and the aircraft on a 5-year basis. Thus $50,000,000 invested in a superliner is tied up for many years after the vessel's speed supremacy has been lost and it is out of date, whereas new aircraft will be replaced at shorter intervals. The relatively low costs indicated for transoceanic flying are remarkable, as it is extremely rare in the history of transport development of any kind that the faster passenger service proves in its early stages to be the cheapest.

As a result of the frequency of schedules possible, the rapidity and convenience of crossing the ocean in less than 24 hours, the low costs and the constantly increasing safety of flying boats, the reign of the superliner is being challenged. The 250,000-pound flying boat predicted by experts as realizable in less than 10 years would still further reduce the cost of carrying a passenger to Europe while carrying him there six times as fast as the superliner.

The traffic loads promised for aircraft over the oceans are large. The flying boat should obtain a substantial portion of the 8000 pounds of mail per day which crosses the Atlantic, as well as many of the travelers now using de luxe accommodations, to say nothing of the new business that is bound to be

created by the faster service. It is significant that the British now intend to carry all first-class Empire mail by air. Overnight air service to Europe would enable a New York business-man to fly to London, spend three days there, and fly home in the time needed to cross one way in a superliner. Dirigibles on a $2^1/_2$-day service have already attracted capacity traffic.

The addition of aircraft to the fleets of shipping companies now seems to be justified. Just as sail gave way to steam, so may the steamship give way to aircraft for fast express service. The ocean-going flying boat or dirigible is really another vessel —a much faster vessel and one that is likely to be cheaper to operate. Not to make use of this new kind of equipment may prove shortsighted to express shipping companies.

Special consideration of the dirigible shows it still may have a rôle in overocean air transportation, with its more logical place, perhaps, in the longer nonstop routes, such as San Francisco and Tokyo. It is more costly than the flying boat but offers greater comfort and, with helium, reasonable safety. Its commanding nonstop, weather-avoiding ability, however, is being met by the flying boat. In comparing the two types, it may be pointed out that there is little doubt as to the value of long-range flying boats as naval auxiliaries, which is not true with respect to dirigibles.

Aircraft Power-Plant Trends

S.A.E. JOURNAL

INCREASE in size and speed of airplanes forewarns of the need of power plants of decidedly greater power, says George J. Mead, vice-president and chief engineer, United Aircraft Corp., in the October, 1937, issue of the *S.A.E. Journal*. Writing under the title "Aircraft Power-Plant Trends," Mr. Mead comes to the following conclusions.

The general trend in engine development continues steadily toward ever-increasing outputs per liter, with the consequent effect of improving the take-off powers and reducing the engine size in the geometric sense. There is reason to believe that the rate of progress of the past decade can be maintained, providing our invaluable allies—the chemist, the metallurgist, and the fuel technician—can keep pace with our needs.

The development of the present standard types definitely tends toward smaller cylinders for the higher outputs. This trend, combined with the general acceptance of the two-row type for the higher powers, has effected a decided reduction in frontal area per horsepower. From the standpoint of performance, take-off powers of 1500 to 1800 hp seem feasible in the period immediately ahead. The ever-increasing importance of operating costs has concentrated attention on this most vital performance characteristic. As a result, great strides have been made in reducing the specific fuel consumption, and there is evidence that service consumptions of 0.40 lb per bhp-hr may be achieved within the next few years.

The evident future need for engines of from 2000 to 3000 hp has focused attention on other types in which additional displacement may be provided through the employment of a greater number of cylinders. The new engine types may result, namely, the cylindrical or multirow radial and the rectangular or flat multibank in-line. The form drag of these types need be no greater than for present-day power plants, despite their decidedly greater output.

Continued improvement in engine cooling has reduced the drag of both the air- and liquid-cooled systems, and there appear to be still further opportunities of betterment. The combined reductions in power-plant drag may well result in cutting the fuel bill by as much as 10 per cent, which, combined with a possible further improvement in specific consumption, gives hope of a net saving of 15 to 20 per cent.

There is every reason to believe that our future engine, as well as airplane, development must continue to be a steady step-by-step process, keeping pace with our knowledge, rather than a sudden advance in much larger equipment. As in the past, each gain must be consolidated by thorough and painstaking tests before further progress is feasible, both from an economic and an engineering standpoint. The problems confronting the designer are more complex than ever before and require both greater time and greater expense for their solutions. Fortunately, the aviation industry has passed through its pioneering days and is now equipped with personnel and experience to deal effectively with these problems. It may truly be said that aviation has at last settled into its stride. For this reason, power-plant development can and will keep pace with requirements.

Plastic Aircraft Materials

FLIGHT

ACCORDING to an announcement in *Flight* for July 22, 1937, the British firm of Deekay Aircraft Corporation, Ltd., has recently approached the subject of aircraft construction in plastics. As shown in Fig. 2, it is proposed to use three main spars in a wing section. The spars have a bulbous section, the plastic material being reinforced by metal tubes molded into the spar flange during manufacture.

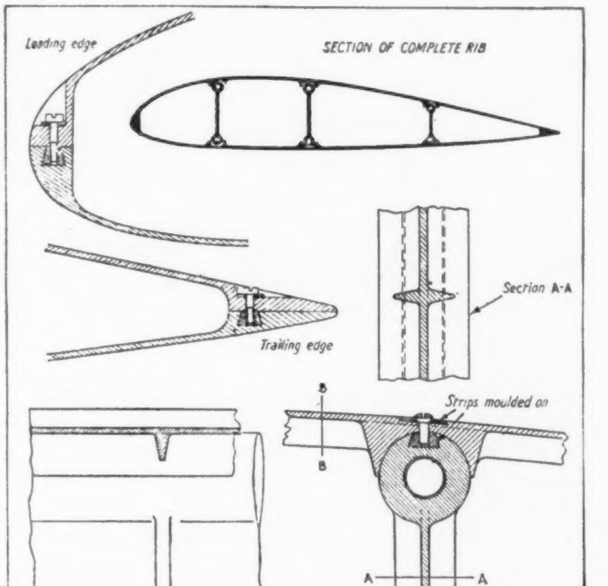


FIG. 2 DETAILS OF WING CONSTRUCTION OF PLASTIC MATERIAL

Stiffening ridges of the spar web are integral with the spar and are to be spaced in accordance with the loads to be supported. The intention is said to be to make the spars in fairly short lengths, 10 ft or so, in order to avoid the cost of large dies and presses. Joints between the spars are to be made by bolting through the metal liners and possibly through reinforc-

ing sleeves and plates. A similar type of joint will be used on the center line where port and starboard spar roots meet.

Another advantage of the bulbous spar booms is that the "handing" and beveling of the surfaces which receive the wing covering may be avoided. The covering, also of plastic material, will be made up in standard-size panels, with chordwise ridges molded on the inside and large spanwise ridges for attaching them to the spar booms. Metal strips will be molded into the spar booms as shown in Fig. 1, and the covering panels will be attached to the spar booms by screws. Should a wing-covering panel be damaged, a standard spare panel can be substituted.

Leading and trailing edges will be of the same general construction as that employed in the spar box, with bolted joints to secure top and bottom surfaces together.

It is said that imperviousness of the plastic material to wind, water, oil, gasoline, and acids presents a number of advantages.

Constant-Speed Propeller

THE ENGINEER

IN December, 1937, the electrically operated feathering propeller of the Curtiss-Wright Corporation was briefly described. In the Aug. 6, 1937, issue of *The Engineer* the Rotol hydraulically operated propeller of the Bristol Aeroplane Company is presented, with the following explanation of its construction.

Fig. 3 is a schematic diagram of the mechanism in which only

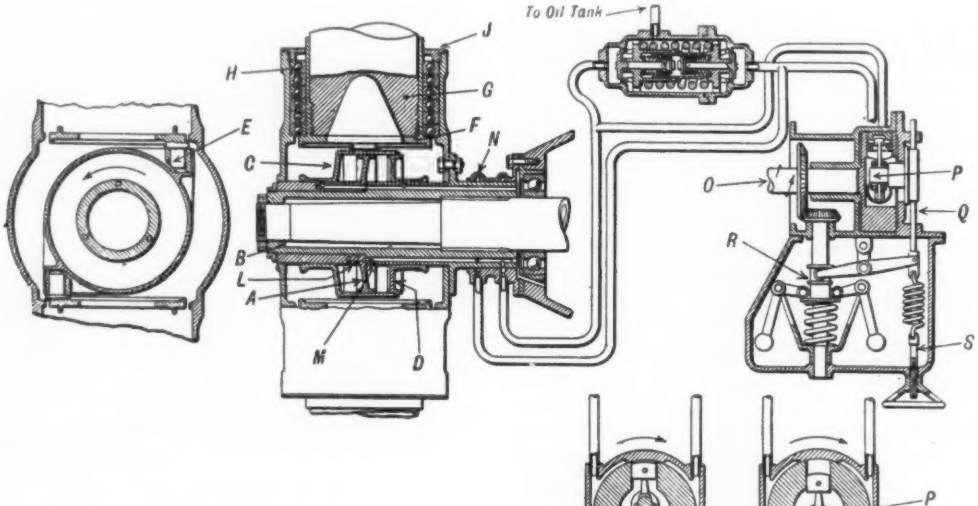


FIG. 3 HYDRAULICALLY OPERATED CONSTANT-SPEED PROPELLER

two blades are shown for clearness. It can be seen that the fixed piston *A* is locked to the hub center *B* and embodies a guide upon which slides the actuating cylinder *C*. Screwed into the rear of the cylinder is the cylinder cover *D*. The bore of the cylinder cover is guided by the journal formed on the hub center behind the piston. The cylinder carries three phosphor-bronze-bushed housings forming bearings for the operating pins *E*, which are integral with detachable lugs bolted to the inner ends of the three blade adaptors *F*. The blade adaptors are screwed and locked to the blade roots *G*, and each carries a stack of four ball-thrust races *H*. The purpose of these races is to transmit the radial thrust and bending moments to the hub. They are fitted between the blade nut *J*, which is screwed into the hub socket and a race nut screwed onto the adaptor. Each of these nuts is locked by means of a serrated locking device.

During assembly provision is made for applying an initial endwise loading to the races, with the object of avoiding all possibility of blade slackness when the airscrew is revolving slowly and when the centrifugal forces on the blade are insufficient for this purpose.

A number of separate drilled passages *L* and *M* in the hub center and in the piston itself convey the oil under pressure to either side of the piston. These passages communicate at the rear of the hub center with the feed pipes from the oil pump by means of an oil seal *N* attached to the front of the engine and bearing on the airscrew shaft through a white-metalled bush. It is claimed that this seal is oiltight under all conditions. Also provided are other drilled passages in the piston guide and hub center, for purposes of lubrication and drainage.

A three-cylinder rotary oil pump is driven by the engine, by means of the shaft *O*, through the engine rear cover. The position of the pump crankpin *P* can be varied in relation to the center of the driving shaft by the movement of the plunger *Q*. The plunger is operated by the sliding sleeve of the governor *R*, which is driven from the shaft *O* by means of bevel gears. The crankpin of the pump is in its central position at the predetermined datum speed of rotation of the propeller, and therefore the pump displaces no oil. At any other speed the governor moves the crankpin off center, whereupon oil pressure is either built up in the passage *L* and reduced in the passage *M*, or vice versa.

The pump, governor, piston, and cylinder characteristics are so designed that at the predetermined speed the cylinder *C* will take up a fore-and-aft position at which—having thereby rotated the propeller blades to the proper pitch—the oil-pressure system is in equilibrium with the blade forces. If, because of

some change in the flight conditions of the aircraft, the propeller speed rises or falls, the governor alters the stroke of the oil pump—and therefore the pressure difference on either side of the piston *A*—in such a way that the cylinder is forced either backward or forward from its normal position. This movement increases or reduces the blade pitch, thereby restoring the propeller speed to its datum and returning the pressure in the system to a state of equilibrium. A governor overriding control *S* is provided, whereby the pilot can vary through a reasonably wide range the propeller speed which he desires to maintain.

Machining Aluminum

ALUMINUM COMPANY OF AMERICA

A 32-PAGE booklet, attractively illustrated, has recently been issued by the Aluminum Company of America. It is called "Machining Aluminum and Aluminum Alloys" and contains information on general machining and automatic screw-machine practice. Five tables cover approximate feeds for standard tools for machining Alcoa 11S-T3 alloy, physical and mechanical properties of 17S-T and 11S-T3 alloys, comparative weights of 11S-T3 alloy and brass and steel standard screw-machine stock, and tolerances.

While commonly used tools for cutting steel will perform satisfactorily on aluminum, the highest grade of work will be obtained, it is said, if the following practices are carried out.

1 Grind more top and side rake on the cutting tools than is common for machining steel.

2 Keep cutting edges sharp and free of burred or wire edges.

3 Maintain smooth, bright tool surfaces free from scratches.

British Labor Relations

FACTORY MANAGEMENT AND MAINTENANCE

THE CHIEF labor officer of the Imperial Chemical Industries, London, E. Lloyd Roberts, in an article entitled "A Case in British Labor Relations," November, 1937, issue of *Factory Management and Maintenance*, says that the common problem of American and British industrialists is the adjustment of human relationships in industry. The company he serves employs about 50,000 manual workers in 55 factories, the number of employees in a factory varying from 50 to 10,000. In some of these factories there are no trade unionists; other factories are 100 per cent organized. In all 20 unions are represented.

The problem, therefore was to keep a scattered payroll of 50,000 contented and to maintain friendly relations with 20 unions while managing the works and making a reasonable profit. In facing this problem, it was recognized at the start that it had to be treated as a major issue along lines just as deliberately studied and executed as those pertaining to technical and commercial matters.

To handle satisfactorily the labor relations of this company there exists a special department, responsible to the Board. It is the duty of this department to secure the uniform administration of the Board's labor policy. This is done by means of group labor officers attached to the various manufacturing groups, with group labor officers represented by plant labor officers in each plant. The central department in London deals with the group labor officers, whose business it is to insure that their plant labor officers carry out the company's policy in the individual plants. The plant labor officers are responsible to their respective plant managers for the proper conduct of the labor relations in that plant.

As a principle of administration, Mr. Roberts conveniently refers to the four C's—contact, consultation, confidence, and cooperation. As to policy, the first principle is not to base wages solely on supply and demand. A national minimum rate, believed to be fair, is established. Rates superior to the minimum are provided for jobs superior to that of the laborer. Dealings with unions are carried on even though the particular union may not have a single member in the factory involved, on the basis that workers themselves are not in any real sense in a fair economic position for bargaining, and hence need the protection of trade unions and union officials experienced in wage negotiations and familiar with the general wage position of the country. This position is said to be justified because of the essentially sane character of the unions.

Mr. Roberts cites examples showing the confidence in each other felt by both sides of wage negotiations and emphasizes the value of knowing union leaders and of treating them in a frank and friendly manner.

However, Mr. Roberts makes it clear that the company insists on regarding workers as employees first and only secondly as trade unionists. Complete contact between company and workers is maintained. No pains are spared, he says, in convincing employees, that, far from being ranged on opposite sides, they and the company are always allied in a common cause.

The company does not permit the unions to "manage" the works. Unions are welcomed as bargaining agencies on wages and basic working conditions, and on such matters as engagement or dismissal of workers, but negotiations are not with unions. Moreover, it is a fixed policy not to deal with more than one union for the same class of employee. In making national agreements, negotiations are between respective headquarters of the company and the union, rather than with local officers.

In addition to relations with unions on matters pertaining to wage problems, the company's policy is concerned with increasing the sense of security of the worker in his job and in his wage. Every employee with five years of service is entitled to be placed in the Staff Grade Plan, which provides a guaranteed minimum wage throughout the year, unless four weeks' notice is given to vary it or to terminate the contract, and the guaranteed wage is paid during absence through sickness or accident up to six months. Experience with this plan has justified its adoption. A pension plan, which in addition to providing invalidity and old-age annuities provides also generous cash payments in case the worker loses his job through no fault of his own, or dies in harness, also contributes to the sense of security.

A third feature of the company's policy is to provide adequate channels of approach through a works-council plan. This plan has three parts: (1) 55 works councils at the individual plants; (2) nine group councils of delegates from works manufacturing the same or allied products; (3) the central council of delegates from each of the group councils. Works councils meet monthly and group councils and the central council twice a year. Every council is a 50-50 body—half nominated by the management and half workers elected by secret ballot. Company affairs are aired at council meetings.

Commenting on the company's labor policy Mr. Roberts says

that it imposes great obligations on the management of a plant. More time and trouble must be devoted to the cultivation of good will with workers; foremen must be educated in the company's policy; autocratic methods must be sacrificed and pains taken to secure cooperation. However, in his opinion, these efforts are worth while.

Engineers' Current Problems

ENGINEERING NEWS-RECORD

A BRIEF note on the recent meeting of The National Council of State Boards of Engineering Examiners, reported in our issue of December, 1937, mentioned an address delivered at the dinner by Willard Chevalier, vice-president of the McGraw-Hill Publishing Company. Colonel Chevalier's address, which was entitled "The Profession's Current Problems," appears in *Engineering News-Record* for Nov. 18, 1937, from which the following excerpts have been taken.

It must be evident, says Colonel Chevalier, that the enactment of a statute does not make a profession. It may create a false sense of security and lead to putting too much faith in the letter of the statute unless behind it is the spirit and the soul of a profession to breathe life into the letter of the law and to give it the force to make it effective. The community sets up a minimum standard, and unless there exists in the engineering profession some vital influence above and beyond the mere statute itself, it will be but a matter of time before those of minimum technical qualifications will demand and be accorded the right to practice regardless of their other professional qualifications.

These other qualifications are of the very essence of what Colonel Chevalier understands to represent a profession. Certainly they mean a great deal in law and medicine because of the confidential relationships with uninformed laymen who are not in a position to protect themselves against the charlatan. When the state qualifies men for the practice of a profession, all it can do is to qualify them by statute by means of a few simple qualifications. The determination of those qualifications is a problem confronting engineering examiners today. What the profession, so far as its statutory regulations are concerned, is worrying about today is how to set them high enough to keep out the unworthy and low enough so that too many will not be left to go somewhere else.

When we start drawing this analogy between the engineer and the doctor and the lawyer, we find that it is the intent and the ambition of the young doctor and the young lawyer sooner or later to go into practice for themselves. This is not true of the great bulk of young engineers, who must look forward to being an employee of the public, of a corporation, or of an individual. We might just as well face the reality and not delude ourselves by setting up fictitious conditions, asserts Colonel Chevalier.

How shall we regulate our profession in the face of that reality? he asks. A great difference exists in the ultimate responsibilities of the men who call themselves engineers by virtue of a definition in a statute or on a diploma. One man may have almost no ultimate responsibility for his work. He is hired by other engineers who take full responsibility for his work, and his ultimate client, the layman, may never know of his existence.

On the other hand, he continues, at the top are men who will carry the ultimate technical responsibility to their clients. Moreover, many engineers who do not have ultimate responsibility will regard the other engineers not as their professional brethren but as their bosses. This results in a very definite problem in the relation between employer-engineer and employee-engineer in so far as their current relationship is concerned.

For this reason Colonel Chevalier believes that the several professional engineering societies today have an even broader field of usefulness and a more important function to perform than they ever had before the statutory licensing of engineers. If we are going to give spiritual effect to the bare flesh and bones of our engineering legislation, he says, we must have these engineering societies which, entirely apart from statutory requirements, will take into account everything else about a man in addition to his educational and technical attainments.

Hence, Colonel Chevalier does not want to see a formal relationship between these two. He does not want to see long-established professional bodies made tails to any statutory kite, nor does he want to see the societies involved in the operation of a licensing statute. In his opinion, they have two different jobs to perform, both of which are vital, and the national engineering societies' function today has become even more vital than before. It is they, he asserts, with their tradition of disinterested and voluntary association for purely professional concerns who must be in a position to establish and enforce those standards of professional responsibility and ethics that cannot be written into a statute.

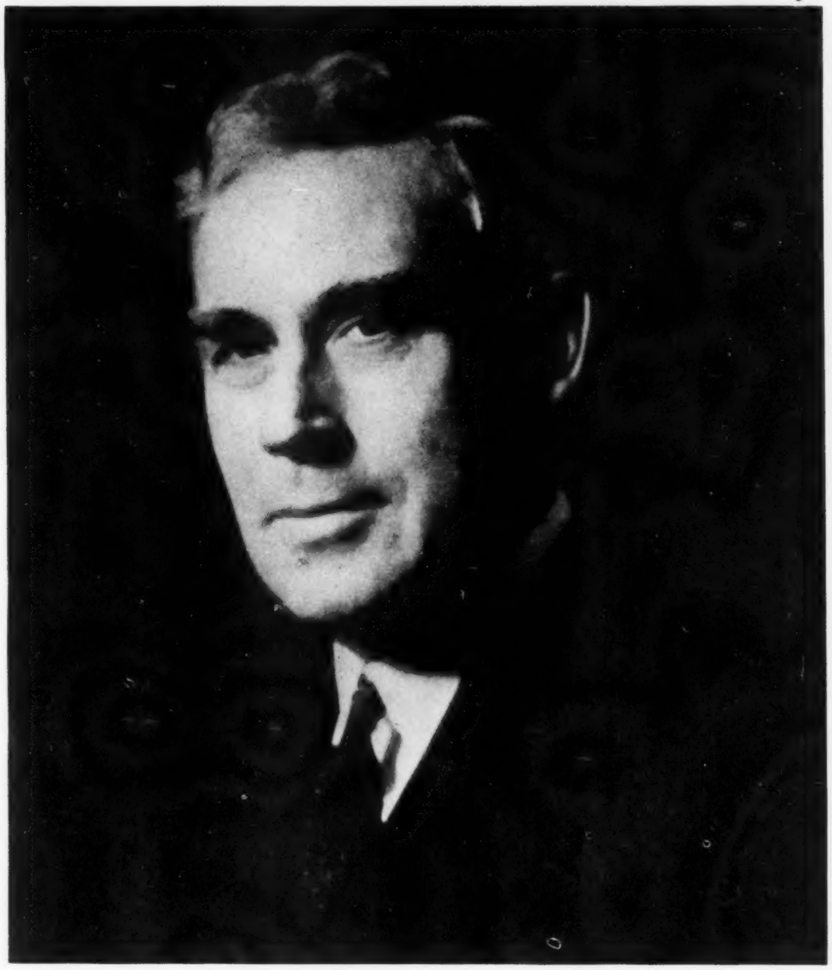
Turning his attention to the employed engineer, Colonel Chevalier next considers the question of the engineer's joining a union. Here he points out that a young man must decide for himself whether he is primarily interested in what a union has to offer him, or has in mind the professional spirit. Colonel Chevalier does not suggest that the young man cannot change his course up to a certain point along his career, but once he has passed that point the chances are that he will not turn back. The young man will have done something to himself and to his outlook on his life and work that will go far toward disqualifying him for the other field of service.

Colonel Chevalier recognizes that there are many thousands of young men who will never have an opportunity to do any more responsible work than they are doing. There is little use, he says, in talking of professional future to men who know that they are close to the limit of their earning capacity. A natural separation by the individual is to be expected. Some will go the way of the labor organization because of its immediate benefits. If they decide that that is the road they want to follow, they have a perfect right to follow it.

On the other hand, he says, if engineers do their job in making the engineering profession attractive to young men, in making the profession seem worth while, in stimulating interest in things not concerned exclusively with today's material interests, then men who can be interested in those things will follow the professional standard, and sooner or later they will find themselves in positions of greater or less responsibility in the profession.

Colonel Chevalier closed his address with the following statement:

Let us then organize our societies and enact our statutes; let us organize our schools to educate these young men and let us do our best to establish working conditions that will recognize sound relationships between employers and employed. Thus we can make clear to them early in their careers the significance of membership in a profession, what it offers, and what it does not offer. Let us do all we can to educate these young men to what a profession is, what it stands for, and what it offers to them in return for what it demands. And when we have done that well, so that they can see the situation clearly, let each of them say under which standard he will serve. That is the best that I now can see to offer. I see no royal road or short cut to the solution of that problem.



HARVEY N. DAVIS

PRESIDENT, A.S.M.E., 1938

A.S.M.E. REGISTERS 2560 AT ITS 1937 ANNUAL MEETING

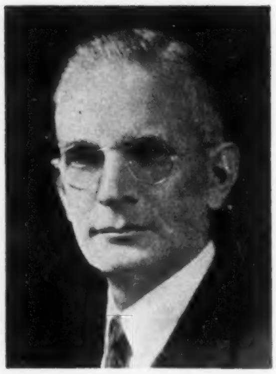
TAXING to the limit the facilities of the Engineering Societies Building, New York, 2560 members and guests of The American Society of Mechanical Engineers took advantage of the 1937 A.S.M.E. Annual Meeting to conduct Society and committee business, engage in the discussion of technical papers, renew old acquaintances and make new ones, and foregather at luncheons, dinners, and college reunions, formal and informal. By means of a number of well-organized inspection trips, visitors from out of town were given the opportunity of seeing some Metropolitan points of interest, technical and otherwise. For the women, who are generally bored and unimpressed by their husbands' enthusiasm for discussing technical matters in a haze of tobacco smoke, a delightful program of entertainment and social gatherings was arranged by the Woman's Auxiliary. What with sight seeing, the theater, and Christmas shopping, the division of interest of the engineer's family at an A.S.M.E. meeting in New York probably raises few complications, and rumor has it that one member satisfied his own conscience and his wife's wishes by presenting her with enough theater tickets to occupy her attention every afternoon and evening of his sojourn among his fellow engineers.

MANY ORGANIZATIONS PARTICIPATE

Coincidentally with the A.S.M.E. Annual Meeting, the Society for the Advancement of Management and the Personnel Research Federation staged conventions during the week and participated in many of the sessions of the Management Division. At the Grand Central Palace the Sixteenth Exposition of the Chemical Industries was also in progress. Cooperating with the A.S.M.E. Hydraulic Division in its sessions on water hammer were the American Society of Civil Engineers and the American Water Works Association, some of the papers being presented under the sponsorship of these bodies. On Honors Night, Robert D. Yarnall, of the United Engineering Trustees, officially represented that organization

B. M. BRIGMAN
Vice-President

HARTE COOKE
Vice-President



F. O. HOAGLAND
Vice-President

W. H. MCBRYDE
Vice-President

NEW OFFICERS OF THE

at the unveiling of the Rice memorial tablet; and at the Annual Dinner presidents and secretaries of sister engineering societies were noted among those present.

SUCCESS ATTRIBUTED TO COMMITTEES

Many months of preparation preceding the meeting were necessary to develop programs and plans necessary for successful operation. Responsibility rests primarily with the Committee on Meetings and Program, of which Harvey N. Davis, newly elected president of the Society, was chairman. Serving with Dr. Davis were Clarke Freeman, R. F. Gagg, W. W. Lawrence, and W. J. Wohlenberg. Special committees were organized to handle the details of the meeting, such as the Annual Dinner, reception, Honors Night, plant visits, the photographic exhibit, and the women's program. The Dinner Committee consisted of Francis Hodgkinson, chairman, Mrs. W. H. Boehm, F. H. Colvin, C. A. Hescheles, C. F. Ryan, W. H. Kushnick, W. W. Lawrence, S. H. Libby, N. H. Memory, E. H. Neff, and J. I. Yellott. On the Reception Committee were Robert Jory, chairman, A. D. Blake, V. M. Frost, W. C. Glass, and O. B. Schier, 2nd. W. A. Shoudy was chairman of the Honors Night Committee, and with him served K. H. Condit, W. G. Hauswirth, and C. B. Peck. Plant visits were under the direction of R. H. McLain, chairman of the committee, assisted by R. B. Purdy, N. S. Slee, and P. W. Swain. The photographic exhibit was arranged by C. G. Humphreys, chairman, J. F. Guinan, L. J. Levert, J. A. Lucas, and W. C. Woodman. Mrs. C. B. LePage acted as general chairman of the group in charge of the women's program. Chairmen of subcommittees were Mrs. F. M. Gibson, registration; Mrs. J. H. R. Arms, excursions; Mrs. Crosby Field, Monday evening events; Mrs. G. L. Knight, luncheon; Mrs. H. V. Coes, Annual Dinner; Mrs. Roy V. Wright, annual tea; Miss Burtie Haar, publicity; and Mrs. C. E. Gus, program.

SOCIETY AFFAIRS DISCUSSED BY GROUP DELEGATES CONFERENCE

Technical sessions at the meeting were arranged by the executive committees of the professional divisions and by a number of the Society's technical and administrative committees, and were coordinated by the Committee on Professional Divisions under the general direction of the Committee on Meetings and Program. The Committee on Professional Divisions consisted of Crosby Field, chairman, George B. Pegram, L. K. Sillcox, Victor Wichum and Harte Cooke.

Member opinion on A.S.M.E. affairs is given expression by means of a series of seven group conferences held in the fall. Resolutions passed at these conferences, in which each of the Society's local sections is represented, are considered in New York by a Group Delegates Conference. Each of the seven groups of local sections is represented at this conference by two delegates, one being elected every year to serve for two years. At the New York Conference, therefore, half of the delegates have participated in a previous conference.

SEVEN GROUPS SEND DELEGATES

The Group Delegates Conference held its first meeting on Sunday, December 5, to organize its committees for a study of the resolutions presented by the fall conferences. At the 1937 Group Delegates Conference J. P. Harbeson, Jr., acted as speaker, C. A. Koepke as vice-speaker, and E. F. Treschow as secretary. The delegates representing the seven groups and the sections of which they are members were as follows:

GROUP I: A. L. Davis, Waterbury; C. P. Howard, Worcester; and R. A. Spence, alternate.

GROUP II: V. M. Frost and John M. Driscoll, Metropolitan.

GROUP III: J. P. Harbeson, Jr., Philadelphia; Paul B. Eaton, Anthracite Lehigh Valley.

GROUP IV: L. J. Lassalle, New Orleans; W. E. McDowell, Charlotte; and Curtis M. Lowry, alternate.

GROUP V: K. F. Treschow, Pittsburgh; E. R. McCarthy, Cleveland.

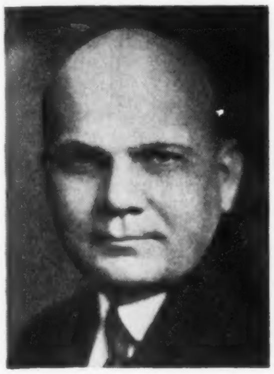
GROUP VI: C. A. Koepke, Minneapolis; D. K. Hutchcraft, Mid-Continent.

GROUP VII: E. O. Eastwood, Western Washington; R. W. Morton, Colorado; and S. F. Duncan, alternate.

Committee chairmen were: Budget, E. O. Eastwood; Membership, A. L. Davis; Organization, L. J. Lassalle; Agenda, V. M. Frost.

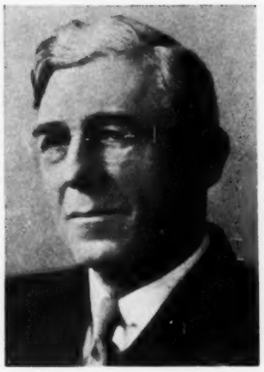
On Sunday evening the Group Delegates met with members of the Council at an informal conference followed by a buffet supper at the Engineers' Club. Grateful acknowledgment is hereby made of the flattering comments by many of the delegates on MECHANICAL ENGINEERING.

In spite of a long program, the Group Delegates were able to complete their discussions on Monday. At the Council meeting on Friday an informal report of the deliberation of the conference was made by Mr. Harbeson. As soon as a formal report is available, the Council will refer to appropriate Society Committees such resolutions as come within their jurisdiction, and when these committees have had an opportunity to consider the resolutions, the Council's actions will be reported to the sections.



L. W. WALLACE
Vice-President

CARL L. BAUSCH
Manager



S. B. EARLE
Manager

FRANK H. PROUTY
Manager

1938 A.S.M.E. COUNCIL

According to custom, the Annual Meeting closes the administrative year, and on the concluding day the new Council takes office as soon as the old Council concludes its business. Thus the Council meets twice, on Monday and on Friday. Monday's meeting was preceded by a meeting of the Executive Committee, held on Sunday, and following adjournment on Friday the 1938 Executive Committee met. A résumé of important actions of the Councils and the Executive Committees will be found in the A.S.M.E. News, pages 96 and 97.

NEW MEMBERS OF COUNCIL TAKE OFFICE

Retiring from the Council are Past-President Conrad N. Lauer; vice-presidents Alex D. Bailey, John A. Hunter, R. L. Sackett, W. A. Shoudy, H. R. Westcott; and managers J. W. Haney and Alfred Iddles. At Friday's meeting, on motion of W. L. Batt, a vote of thanks and appreciation was recorded for the work of the retiring members of the Council and the Executive Committee. Mr. Herron introduced the new members of the 1938 Council: Harvey N. Davis, president; Bennett M. Brigman, Harte Cooke, Frank O. Hoagland, Warren H. McBryde, and L. W. Wallace, vice-presidents; and Carl L. Bausch, Samuel B. Earle, and Frank H. Prouty, managers.

W. D. Ennis and C. E. Davies were reappointed treasurer and secretary, respectively.

Senior Councilors for 1938 were named by President Davis as follows: Group I, S. W. Dudley; Group II, K. H. Condit; Group III, Harte Cooke; Group IV, E. W. Burbank; Group V, B. M. Brigman; Group VI, W. C. Lindemann; Group VII, W. Lyle Dudley.

COUNCIL LUNCHES WITH GROUP DELEGATES AND PROFESSIONAL DIVISION COMMITTEEMEN

On Monday noon, at the Hotel Astor, the Council met at luncheon the Standing Committees, the Local Section Delegates, and the Professional Division committeemen. Seated at the speakers' table were W. R. Woolrich, chairman, Committee on Local Sections, who presided, President Herron, President-Elect Davis, Past-President Potter, Vice-President Harry R. Westcott, Treasurer Ennis, and Secretary Davies.

Mr. Herron, in a brief informal talk, reminded his hearers that it was not necessary to put very much into the Society in order to get a great deal out of it, and illustrated his views by recalling the parable of the loaves and the fishes. Dr. Davis said that he expected to learn a lot about the Society during the coming year and asked the cooperation of all members in making of greatest benefit to the Society such opportunities as he might have in visiting local sections during his presidency. Dean Potter testified to the value of the experience of serving as president of the Society. Messrs. Westcott, Ennis, and Davies were introduced, and a special word of welcome was extended to Earl F. Scott, of Atlanta, by Dean Woolrich.

PRESIDENT HERRON ADDRESSES BUSINESS MEETING

On Monday afternoon President Herron called to order the 1937 Annual Business Meeting of the Society and introduced C. E. Davies, secretary, who presented in abstract the annual report of the Council which will be found on pages 9 to 18 of this issue. He also called attention to the report of the Finance Committee (pages 19 to 21).

A resolution, on the death of Ambrose Swasey, adopted by the Council and prepared by its committee consisting of Dexter S. Kimball and J. W. Roe, was read and adopted unanimously by the members present. The resolution follows:

RESOLUTION ON THE DEATH OF AMBROSE SWASEY

In the death of Ambrose Swasey the nation has lost one of its most distinguished engineers, and the Society one of its best-beloved members. Ambrose Swasey and his partner, Worcester Reed Warner, were among the small group who laid its foundations and devoted time and energy to its upbuilding. He was outstanding in that group, and his passing is the parting of one of our last links with it. His many accomplishments and important contributions will be fully recorded elsewhere. Here we wish to honor him for his long and notable service as a member of the Society and for what he was.

It would be difficult to enumerate the many ways in which he served it, as a leader in formulating its early policies, as president in 1904, and as a wise adviser for many years. His counsel was much sought and freely given from his wealth of experience. His splendid gifts to the engineering profession and to the widening of engineering knowledge through research and education were but the overflow from his own deep life. He himself was larger and finer than anything he had or did.

It will not be chiefly for his achievements that he will be remembered by those who knew and loved him, but rather for the kindly word and generous judgment and for the personal influence, which ripened with age. These will be treasured throughout life by all who knew him.

Of all the engineers and industrial leaders of this era none stands higher, and this Society is proud that he was identified with it for over half a century. Be it therefore

Resolved, That The American Society of Mechanical Engineers hereby expresses its deep regret at the passing of its distinguished member and past-president, Ambrose Swasey. We hold in grateful remembrance the many services he rendered to the Society and we cherish the memory of this kindly, sympathetic, and lovable character. Ripe in years and

Wide World Photos

JAMES H. HERRON, PRESIDENT OF THE A.S.M.E., PRESENTING THE A.S.M.E. MEDAL FOR 1937 TO EDWARD P. BULLARD AS FREDERICK G. COTTRELL, RECIPIENT OF THE HOLLEY MEDAL FOR 1937, LOOKS ON WITH HIS AWARD

rich in honors, he has passed to his reward. It is a life such as his that strengthens our hope of immortality. Few men have lived such a rich, full, and helpful life, and if he could speak to us, he would say

Twilight and evening bell,
 And after that the dark,
And may there be no sadness of farewell
 Where I embark.
For though from out our bourne of Time and Place
 The flood may bear me far,
I hope to see my Pilot face to face
 When I have crossed the bar.

RETROSPECTION AND PROSPECTION

In his presidential address, which Mr. Herron delivered following the reading of the resolutions, attention was drawn to the Society's accomplishments during the past year and to the president's views on the problems of the immediate future. The full text of this address, which Mr. Herron called "Retrospection and Prospection" will be found on pages 5 to 7 of this issue.

NOMINATING COMMITTEE PERSONNEL ANNOUNCED

Upon being recognized by Mr. Herron, W. R. Woolrich, chairman, Committee on Local Sections, read the names of members of the Nominating Committee for 1938, chosen by the Local Sections Group Conferences. The committee personnel, approved by vote of the members at the Business Meeting, is as follows:

GROUP I: T. H. Beard, representative, Dictaphone Corp., 375 Howard Ave., Bridgeport, Conn.; W. L. Edel, alternate, Conn. State College, Storrs, Conn.

GROUP II: F. M. Gibson, representative, American Sugar Refining Co., 49 S. 2nd St., Brooklyn, N. Y.; T. Baumeister, Jr., alternate, Columbia University, New York, N. Y.

GROUP III: H. L. Whittemore, representative, National Bureau of Standards, 3906 McKinley St., N. W., Washington, D. C.; G. E. Crofoot, alternate, University of Pennsylvaina, 33rd and Locust St., Philadelphia, Pa.

GROUP IV: F. L. Wilkinson, representative, University of Tennessee, Estabrook Hall, Knoxville, Tenn ; R. M. Rothgeb, alternate, Budget Bureau, Raleigh, N. C.

GROUP V: H. C. Anderson, representative, University of Michigan, Ann Arbor, Mich.; James Burke, first alternate, Burke Electric Co., Erie, Pa.; F. C. Hockema, second alternate, Purdue University, West Lafayette, Ind.

GROUP VI: R. M. Boyles, representative, 525 International Bldg., St. Louis, Mo.; E. H. Sager, alternate, Washington University, St. Louis, Mo.

GROUP VII: G. L. Sullivan, representative, University of Santa Clara, Santa Clara, Calif.; H. J. Smith, first alternate, Pacific Gas and Electric Co., 245 Market St., San Francisco, Calif.; H. B. Langille, second alternate, University of California, Berkeley, Calif.

At an organization meeting of the Nominating Committee for 1938, held on Dec. 9, 1937, F. M. Gibson was elected chairman and F. L. Wilkinson secretary of the committee.

President Herron next called upon Gen. C. H. Mitchell, dean, University of Toronto, past-president, Engineering Institute of Canada, and A.S.M.E. Fiftieth Anniversary Medalist, who rose to acknowledge the applause of greeting from members of the Society, and a brief word of welcome from President-Elect Harvey N. Davis.

At his request John Parker, of Philadelphia, was granted the privileges of the floor in order that he might read a preprinted statement previously presented to the Council, which he amplified with a few remarks. At the conclusion of the remarks, Clement Street moved a vote of confidence of the members present "in their officers' ability to handle the question that has been presented." This motion was carried; and, on another motion, the meeting adjourned.

AWARDS CONFERRED ON HONORS NIGHT

Members of the A.S.M.E. have come to look upon Honors Night as one of the high lights of the Annual Meeting. On this occasion, formal announcement is made of the election of officers for the coming year, the president-elect is introduced, prizes, awards, and honorary memberships are conferred, and, usually, one of the Society's lectures is delivered.

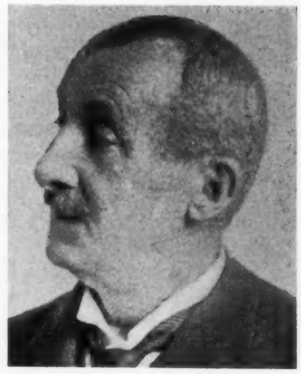
Honors Night at the 1937 meeting was preceded by a dinner at which recipients of awards and honors were guests of the Council. Following assembly on the platform of the auditorium in the Engineering Societies Building, President Herron called for a report of the tellers of election, which was read. President-Elect Davis was escorted to the platform where he was greeted by Mr. Herron. In his response Dr. Davis expressed the hope that his administration would be a forward-looking one and pledged his active support of the Society's ideals and activities.

In presenting candidates for honors, the Committee on Awards designates a distinguished member to introduce the recipient to the president with an appropriate summary of the accomplishments for which the award is made. The president, in acknowledging the introduction, presents the certificate and medal pertaining to the award with congratulatory comments.

HONORARY MEMBERSHIP CONFERRED ON LORENZO ALLIEVI

Representing the A.S.M.E. Hydraulic Committee and the Committee on Water Hammer, S. Logan Kerr reviewed the contributions to hydraulics of Lorenzo Allievi, of Italy, an eminent engineer 81 years old who is still actively working in the field of water hammer, who had been elected honorary member of the Society. In Dr. Allievi's absence, the certifi-

D. ROBERT YARNALL



LORENZO ALLIEVI

EARNEST A. HOOTEN

PROMINENT FIGURES AT A.S.M.E. ANNUAL MEETING

(Mr. Yarnall, President of the United Engineering Trustees, unveiled the Calvin W. Rice Memorial Plaque on Honors Night; Signor Allievi, unable to be present, was awarded Honorary Membership in the A.S.M.E.; Professor Hooton delivered the Towne Lecture.)

cate of honorary membership was received, and a response made, by Fulvio de Suvich, Italian Ambassador to the United States.

A summary of Dr. Allievi's achievements, prepared by Robert W. Angus, of the University of Toronto, follows:

All those interested in the investigation of pressure shock due to change of velocity of water in pipes are familiar with the name of Allievi, although few people in America knew much about the particular work he had done till the English translation of his water-hammer paper appeared in 1925.

Lorenzo Allievi was born in Milan on November 18, 1856, and received his engineering education at the University in Rome. After graduation he spent about a year in Germany and later returned to the teaching staff of his own university where he remained four years; but as he desired to have a more definite connection with practical engineering, he severed his university affiliations and entered the practice of railway building and the construction of power plants and electro chemical factories, his railway work including lines in Italy proper and also in Sicily. His mind always had a tendency toward mathematics and theoretical research, although his papers show that he has used mathematics as a tool, and has always presented his work in such simple form as to be read by those who have forgotten much of the mathematical theory.

One of his earliest publications was a paper printed by the R. Accademia dei Lincei, Vol. 4, December, 1895, entitled "Cinematica della Biella Piana," in which he made a generalized analysis of the four-link mechanism; this study was carried out during a period of rest due to illness.

In a letter to the author of these notes he says, "I did not care for hydraulics till my forty-sixth year when my attention was drawn to the water-hammer phenomena by the breaking, in the spring of 1902, of a pipe 1.80 m in diameter in a carbide factory near Terni, of whose board I was a member." Finding that any solution of water-hammer problems was lacking in English and German technical literature, and that the French treatment of the problem was unsatisfactory, he constructed his own theory which was published in 1902 under the title "Teoria Generale del moto perturbato dell'acqua nei tubi in pressione" (General Theory of the Variable Motion of Water in Pressure Conduits), which he also translated into French for publication in the *Revue de Mécanique* in 1904.

Of this paper Dr. R. Neeser, former professor at the University of Lausanne, says (as given in the translation of the "Theory of Water Hammer," by Eugene Halmos), "This remarkable study differs from all monographs previously published on the important question of water hammer both as to the originality of the method employed and as to the importance and novelty of the obtained results. Not wishing to use the paths already broken by his predecessors, and aiming primarily to come as close as possible to the solution of the phenomenon, Allievi starts by systematically and knowingly ignoring all that was accomplished before him; he takes up the problem at its origin and presents it as his remarkable intuitional qualities make him foresee that it must be."

Becoming again absorbed in his general engineering practice he paid no further attention to hydraulics till 1909–1910, when, during some leisure time, he resumed his water-hammer studies, the result of which was his "Theory of Water Hammer," Notes I–V, first published in the "Atti del Collegio degli Ingegneri ed Architetti," Milano, 1913, a work so important that it has been translated into French, German (modified), and finally into English by Mr. Halmos, the latter translation being distributed by The American Society of Mechanical Engineers and others. It is not necessary here to point out the remarkable nature of this paper, for it has been quoted and used in so many ways that it is well-known to engineers. The translations were delayed by the war and did not appear till about ten years after the paper was first published, which accounts for the slow appreciation of its full value.

These unusual gaps between the papers of Dr. Allievi are thus accounted for by circumstances which he could not control, but in his letter he goes on to say, "As I attained my seventy-fifth year, and disburdened myself of the largest part of my former business, the water-hammer phantoms again seduced and seized me and cheer now the last years of my long life." These studies have resulted in four published papers:

"Derivazione elementare delle formule generali del moto idraulico perturbato" (Elementary deductions of the general formulas of the variable flow in pipes). *L'Elettrotecnica*, Vol. 20, May 15, 1933.

"Le coup de bélier et le réglage automatique des turbines hydrauliques" (Water hammer and automatic regulation of hydraulic turbines). *Revue générale de L'Électricité*, Vol. 33, July 1, 1933.

"Arresto di una colonna liquida in moto ascendente" (Stopping an ascending liquid column). *L'Elettrocnica*, Vol. 21, Oct. 25, 1934. This paper deals with the effect of flywheels.

"Camere d'aria nelle tubazioni prementi" (Air chambers in pump discharge lines). *L'Electtrotecnica*, Vol. 23, Oct. 25, 1936.

All of Allievi's papers deal with the simple pipe and he has published nothing on compound and branched lines.

Last May the author of these notes went to Rome very largely for the purpose of visiting Signor Allievi after a cordial and gracious invitation from him to do so. The warm, kindly greeting he gave the author when he first saw Signor Allievi will always remain in the author's memory as one of the happiest events of his life. Despite advanced age he goes about his house freely, never uses glasses, and has as keen a mind as brilliant men have in their prime. My visit to his home was an inspiration; there was such a delightful and happy spirit there and a respect, one might almost say reverence, for the man who not only knows one thing well, but is a source of information on many subjects, as was evidenced in his conversation.

It was to me a great satisfaction to see this venerable Italian gentleman so virile in mind working away on new papers, and often sitting

ROY V. WRIGHT GINO J. MARINELLI

MR. WRIGHT PRESENTED MR. MARINELLI FOR UNDERGRADUATE STUDENT AWARD

up to the "wee sma' hours" plotting his intricate diagrams. Assuredly all those genuinely interested in technical things will join in wishing continued happiness and good health to Signor Lorenzo Allievi.

STUDENT AWARD CONFERRED ON GINO J. MARINELLI

In presenting Gino J. Marinelli, a graduate of the Rensselaer Polytechnic Institute in 1937, for the under-graduate student award of $25 for the best paper submitted by a student member of the Society, Roy V. Wright, past-president, A.S.M.E., said:

Henry Hess of Philadelphia, a past-president of the Society, was keenly interested in encouraging the younger men about to enter the engineering profession. In addition to the Junior Award, he created a fund in 1914 to insure two annual awards to members of Student Branches, for the best papers or theses submitted. In recent years, one of the awards has been made to an undergraduate and the other to a postgraduate student. This year no papers were submitted in the latter class.

The award to the undergraduate student goes to Gino J. Marinelli, for his thesis "Investigation of the Towing Resistance of a Model Submarine Hull," which was submitted as one of the requirements for the degree of bachelor of science in mechanical engineering at Rensselaer Polytechnic Institute. Quite possibly the fact that Mr. Marinelli comes from New London, the well-known naval base, is responsible for his interest in this particular subject.

The records show that as a student Mr. Marinelli was exceptional in his earnestness and the thorough way in which he went at any tasks assigned to him. Unassuming in disposition, he nevertheless, in a pleasant way, was insistent on wanting to know all the whys and wherefores of problems under consideration. His thesis, including the orderly and logical way in which it is presented and the attractive manner in which the material is assembled, reflects these qualities.

CHARLES T. MAIN AWARD PRESENTED TO ALLAN P. STERN

Allan P. Stern, recipient in 1937 of the Charles T. Main Award, was presented by R. C. H. Heck. The Charles T. Main Award of $150 in cash was established in 1919 by Charles T. Main, past-president of the Society, to be awarded, with a certificate, to a student member of the Society for the best paper on the general subject of the influence of the engineering profession on public life. Mr. Stern, a native of Cleveland, Ohio, was graduated from the Case School of Applied Science in 1937 with the degree of bachelor of science in mechanical engineering. He was chairman of the A.S.M.E. Student Branch at Case during his senior year. At present he is employed with the Colonial Iron Works Company, of Cleveland, engaged in the manufacture of material-handling equipment.

LESLIE J. HOOPER RECEIVES JUNIOR AWARD

The Junior Award of $50 was established in 1914 by a fund created by Henry Hess, past-president of the Society, to be presented, with a certificate, for the best paper submitted by a junior member. L. P. Alford, in presenting Leslie J. Hooper, of Worcester Polytechnic Institute, for the 1937 award, said:

Leslie J. Hooper, recipient of the Junior Award of The American Society of Mechanical Engineers for 1937, was born Feb. 15, 1903, at Essex, Mass. His grammar and high-school education was received in the public schools at Millbury, Mass. In 1924 he was graduated from Worcester Polytechnic Institute with the degree of bachelor of science in mechanical engineering. This was followed in 1928 with the degree of mechanical engineer, also conferred by the Worcester Polytechnic Institute.

The three years following graduation were spent in the employ of the Canadian and General Finance Company, Ltd., working at their various hydraulic plants in Brazil in the capacity of a hydraulic test engineer. The work consisted in measuring the discharge of water wheels for acceptance and operating tests, calibration of large venturi meters in place, deceleration tests of generators, static overpressure tests of penstocks, tests of pressure rise due to governor action, extensometer tests of banded steel type and thermometric efficiency tests. The methods of water measurement used were the salt-velocity, the current-meter, and the volumetric.

Since 1927 Mr. Hooper has been employed by Prof. C. M. Allen, of the Worcester Polytechnic Institute, in the performance of hydraulic field tests and laboratory work. The field work has consisted of acceptance tests by the salt-velocity and current-meter methods and dynamometer tests of water wheels. The laboratory work has comprised the calibration and use of weirs, venturi meters, pitometers, ship logs, current meters, model tests of water wheels and draft tubes, hydraulic structures, and rivers.

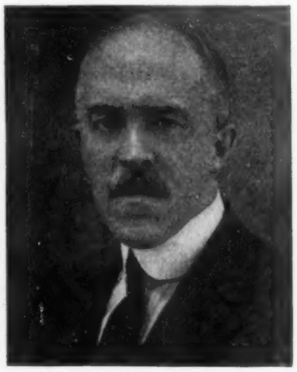
In addition to laboratory and field work, Mr. Hooper has been a part-time instructor in hydraulics at the Worcester Polytechnic Institute since 1932. In 1934 leave of absence was granted to allow the acceptance of a John R. Freeman Traveling Fellowship for the inspection of hydraulic laboratories in the United States and Canada.

Mr. Hooper is coauthor with Prof. C. M. Allen of three papers: "Piezometer Investigation," Transactions A.S.M.E., 1932; "Venturi and Wier Measurements," MECHANICAL ENGINEERING, 1935; and "American Hydraulic-Laboratory Practice," Transactions A.S.M.E., 1936.

The paper for which The American Society of Mechanical Engineers Junior Award is made is entitled, "American Hydraulic-Laboratory Practice."

MELVILLE MEDAL AWARDED TO ALFRED J. BÜCHI

In the absence of Alfred J. Büchi, of Switzerland, the Melville Medal for 1937, awarded to him, was handed to Harte



R. C. H. HECK ALLAN P. STERN

PROFESSOR HECK PRESENTED MR. STERN FOR THE CHARLES T. MAIN AWARD

Cooke, for delivery to him upon his arrival in this country. The Melville Medal, established in 1914 by the request of Rear Admiral George W. Melville, past-president and honorary member of the Society, is presented, with a certificate, for an original paper of exceptional merit. The 1937 award to Mr. Büchi was based on a paper entitled "Supercharging of Internal Combustion Engines With Blowers Driven by Exhaust-Gas Turbines."

Mr. Cooke reviewed the medalist's engineering career in presenting his name as recipient of the award. Alfred J. Büchi, a native of Winterthur, Switzerland, is the son of J. Büchi, former works manager of the Sulzer Works, Winterthur. His early education was received in the Winterthur primary and grammar schools and at the Swiss Institute of Technology, and his early apprenticeship was spent at the Sulzer works. From 1903 to 1906 he worked with Carels Brothers, Ghent, on Diesel engines and gas turbines, and from 1907 to 1909 he was associated with Honegger and Company, Wetzikon, Switzerland. From 1909 to 1918 he was chief engineer in charge of the Diesel-engine research department of Sulzer Brothers. In 1927 he formed the Büchi Syndicate at Winterthur, of which he was made president. In addition to this position, he was general manager of the Diesel-engine department of the Swiss Locomotive and Machine Works, Winterthur, from 1928 to 1934.

FREDERICK G. COTTRELL RECEIVES HOLLEY MEDAL

The Holley Medal, instituted in 1924 by George I. Rockwood, past vice-president of the Society, to be bestowed with a certificate for some great and unique act of genius of engineering nature that has accomplished a timely public benefit, was awarded in 1937 to Frederick Gardner Cottrell, of the Research Corporation, Washington, D. C., "for his eminent public service, for the invention of electric precipitation, for the advancement of the science of gas liquefaction, for his gifts to engineering research." In presenting Dr. Cottrell for the award, L. W. Wallace, director of engineering and research, The Crane Company, Chicago, Ill., said:

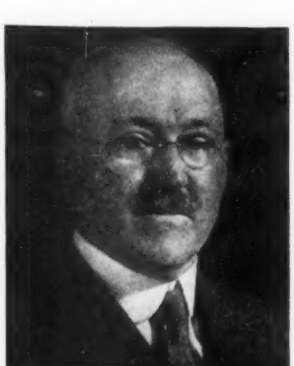
There was a time when the process of refining minerals sent injurious dust to the lungs of workmen, devastation to surrounding vegetation, and valuable mineral dust out of smoke stacks. These things need not occur now. Similar things need not happen in other industries than mineral refining. The reason for all this is the process of electric precipitation. A process whereby dust is snared and profitably used. Thus, millions of dollars worth of valuable mineral dust have been saved, untold acres of vegetation protected, and human life conserved.

The patentee of the electric-precipitation process could have made a fortune. He did not because of his zeal to render a public service. He dedicated the patent to the public by providing that the royalties realized thereon be devoted to financing scientific and engineering research. Today educational institutions, struggling young technical men, and inventors are the beneficiaries of the generosity of the patentee. And this is not all—there is accumulating a patent pool, all the proceeds of which will be deposited in one envelope marked "dedicated to the public." Thus the frontiers of knowledge are being penetrated and the well-being of mankind enriched.

In 1923 George I. Rockwood, a member of The American Society of Mechanical Engineers, established the Holley Medal. The gift of deed specifies that this medal is to be bestowed for some great and unique act of genius of an engineering nature that has accomplished a great and timely public benefit. It is the unanimous decision of the Committee on Medals that the process of electric precipitation fully and truly meets the requirements of this deed of gift. Therefore, Mr. President, the Committee, with deep satisfaction, presents Dr. Frederick Gardner Cottrell to receive the Holley Medal because of his preeminent public service, his genius in perfecting the process of electric precipitation, his advancement of the science of gas liquefaction, and his gifts to engineering research.


L. W. WALLACE FREDERICK G. COTTRELL

MR. WALLACE PRESENTED DR. COTTRELL FOR THE HOLLEY MEDAL




L. P. ALFORD LESLIE J. HOOPER

MR. ALFORD PRESENTED MR. HOOPER FOR THE JUNIOR AWARD

WORCESTER REED WARNER MEDAL AWARDED TO C. F. HIRSHFELD

In presenting Clarence F. Hirshfeld, of The Detroit Edison Company, for the Worcester Reed Warner Medal, Geo. A. Orrok, honorary member, A.S.M.E., said:

Our late past-president and honorary member, Worcester Reed Warner, in his will bequeathed funds for the establishment of the Worcester Reed Warner Medal for outstanding contributions to permanent engineering literature. This medal has been awarded on four previous occasions the recipients being, in 1933 Dexter S. Kimball, in 1934 Ralph E. Flanders, in 1935 Stephen Timoshenko, and in 1936, Chas. M. Allen. Your committee this year has selected from many possible candidates a man worthy to shine even in the company of the galaxy of medalists just cited.

Born on the shores of the Pacific, graduated from the University of California, he came east to Cornell where for ten years he successively served as instructor, assistant professor, and finally as professor of mechanical engineering. Leaving the university in 1913 he associated himself with The Detroit Edison Company organizing the research department of that company of which he is still chief. He has received the degree of doctor of engineering from Rensselaer, the American Institute of Electrical Engineers' prize, and other honors.

His major interest has been heat-power engineering and applied thermodynamics, and a number of authoritative textbooks and papers have made the results of his work the property of all engineers.

He has been a pioneer in applying the research method to the problems of industry. His latest problem, the rehabilitation of the trolley car, is just coming into fruition.

It now becomes my duty as it is my pleasure to present to you the fifth recipient of the Worcester Reed Warner Medal for his research and contributions to the theory and practice of heat-power engineering as

GEO. A. ORROK

C. F. HIRSHFELD

MR. ORROK PRESENTED DR. HIRSHFELD FOR THE WORCESTER REED WARNER MEDAL

J. W. ROE

EDWARD P. BULLARD

PROFESSOR ROE PRESENTED GENERAL BULLARD FOR THE A.S.M.E. MEDAL

exemplified by books and papers, our good friend whom we delight to honor, Clarence Floyd Hirshfeld.

A.S.M.E. MEDAL BESTOWED ON EDWARD P. BULLARD

The A.S.M.E. Medal was established by the Society in 1920, to be awarded with a certificate for distinguished service in engineering and science. The 1937 award of the medal was made to Edward P. Bullard, president, Bullard Company, Bridgeport, Conn., "for preeminent leadership in the development of station-type machine tools." Mr. Bullard was presented for the award by Joseph W. Roe, professor-emeritus of industrial engineering, New York University.

Edward Payson Bullard was born in 1872 at Columbus, Ohio, and was educated in the public schools, at Williston Seminary, Easthampton, Mass., and at Amherst. He entered his father's plant at Bridgeport in 1892, and after working his way up through the shop he spent two years in Europe selling and demonstrating machine tools.

The Bullard Company had already applied the turret to the boring mill, adapting it to repetition work. In 1900 Mr. Bullard carried the principle further in the vertical turret lathe as a result of his contact with automobile production in the Panhard works. In this machine he used continuous-flow forced lubrication which was new in machine tools at that time. This machine was so successful in automobile production that a larger size was brought out for railway work.

In 1913 Mr. Bullard developed the vertical multispindle, station-type of lathe known as the "Multa-matic," especially designed for high production in automobile manufacture. This was followed by the "Continumatic" in 1922, which carries still further the use of simultaneous operations in one tool. These machines have had wide influence here and abroad.

CALVIN W. RICE MEMORIAL TABLET UNVEILED

To members of The American Society of Mechanical Engineers who knew and admired Calvin W. Rice, secretary of the Society from 1906 until his death in 1934, the unveiling of a bronze tablet to his memory marked the high point of Honors Night events. Standing on an easel at one side of the platform was the veiled tablet from which the covering was removed by Robert D. Yarnall, member, A.S.M.E., and president, the United Engineering Trustees. A photograph of the tablet will be found on page 83. Mr. Yarnall said:

It is not necessary for the engineers of this generation to have a memorial in bronze or stone for Calvin Winsor Rice, because we knew him, and the memory of his human qualities, and his outstanding contribution to the advancement of our profession, whether mechanical, civil, mining, electrical, or chemical engineering, will last as long as we shall live; but it is fitting that future generations should have such a lasting memorial to perpetuate the memory of this outstanding engineering leader of our generation.

The United Engineering Trustees, the custodian of this building and other properties of the Founder Societies, through a committee of which Mr. William L. Batt is chairman, has prepared a bronze tablet which is on the platform tonight.

A rule of the Trustees made in the tempered wisdom of our leaders in the past, and approved by engineers of today, decrees that memorials may not be placed in the public halls of the Engineering Societies Building until five years have elapsed since the death of those to be memorialized. Two years therefore remain before we can permanently erect this tablet at an appropriate place in the lobby of this building. It is fitting, therefore, that this memorial which will now be unveiled be placed in the custody of the Society which Dr. Rice served so acceptably as secretary from 1906 until 1934.

The face of the tablet contains the following words:

"Calvin Winsor Rice, Erected in Appreciation of a Life Devoted to the Advancement of the Profession of Engineering and of his Active Part in Obtaining from Andrew Carnegie the Gift of the Engineering Societies Building."

On behalf of the United Engineering Trustees it is now my privilege to unveil this memorial tablet to Calvin Winsor Rice and to turn it over to the custody of The American Society of Mechanical Engineers until such time as it can be permanently built into the walls of this building for which Mr. Rice was so largely responsible.

"Though he were dead, yet shall he live."

SEEING THE UNSEEN

Concluding the exercises of Honors Night was an illustrated address, with demonstrations, delivered by R. Merwin Horn, of the photographic department, Massachusetts Institute of Technology. Mr. Horn's address constituted the Thurston Lecture for 1937.

The Thurston lecture was instituted in honor of Robert Henry Thurston, first president of the Society, in recognition of the close relationship of science to engineering. Mr. Horn's address consisted principally of comments on his demonstrations and illustrations. An article, which will describe the camera used by Mr. Horn in taking the photographs and motion pictures shown, and the manner in which the high-speed camera is useful in the solution of industrial and engineering problems, will be published in a later issue of MECHANICAL ENGINEERING.

Numerous illustrations appearing in this months' issue have been provided by Mr. Horn to show the character of the results obtained by the camera.

Mr. Horn first explained and demonstrated the principle of the stroboscope by means of which he apparently made rapidly

revolving objects stand still, and described how the device can be used in a study of rapidly moving machinery.

The principal portion of the address, which was entitled "Seeing the Unseen," consisted of photographs taken with the high-speed camera and motion-picture films showing such fast-moving objects as humming birds. He showed the disturbance caused by an object falling into a liquid, the breaking of a pane of glass and a cup of coffee, the shattering of an electric-light bulb by a hammer, the various shapes assumed by a drop falling from a pipette, water emerging from a tap, and other phenomena, equally impossible to visualize without the aid of special cameras and lighting arrangements. Most of the pictures shown, including those used in this issue, were made with exposures of less than one one-hundred thousandth of a second, illumination being provided by means of a spark.

MORE THAN 700 DINE AND DANCE

Under the resourceful and vigorous leadership of Francis Hodgkinson, the Dinner Committee offered some innovations in the entertainment features of Wednesday nights' affair that greatly pleased the 720 members and guests who attended the 1937 A.S.M.E. Annual Dinner at the Hotel Astor. A redecorated ballroom greeted this year's diners and created some comment among those who have attended these affairs over a period of years. At the organ, this year an electrical instrument provided through the courtesy of the Hammond Organ Studios, New York, Leslie N. Leet, member, A.S.M.E., had assumed his customary place before the ballroom doors were opened and remained there throughout the dinner, rendering a program of appropriate music.

Seated at the speakers' table were President Herron, President-Elect Davis, The Towne Lecturer, Earnest A. Hooton and the dinner speaker, Floyd Parsons, and past-presidents W. L. Batt, D. S. Jacobus, D. S. Kimball, Conrad N. Lauer, Charles T. Main, A. A. Potter, and Roy V. Wright. In front of the speakers were tables provided for the "fifty-year members," "fifty-fivers," "forty-year members," and "thirty-fivers."

After-dinner speaking was preceded by the singing of the "Star Spangled Banner," by Mrs. W. A. Shoudy, with darkened room in which spotlights played on American flags.

Although nine members attained the fifty-year status during 1937, only four were present; John T. Boyd, Winfield S. Huson, Charles L. Huston, and A. Parker Smith. Amid applause these men received the fifty-year medals from President Herron, who also called upon the forty-five, forty, and thirty-five year "classes" to rise. Past-President Charles T. Main and Edward Needles Trump were introduced as members who had already attained the fifty-year membership status.

THE "FIFTY-YEAR BOYS"

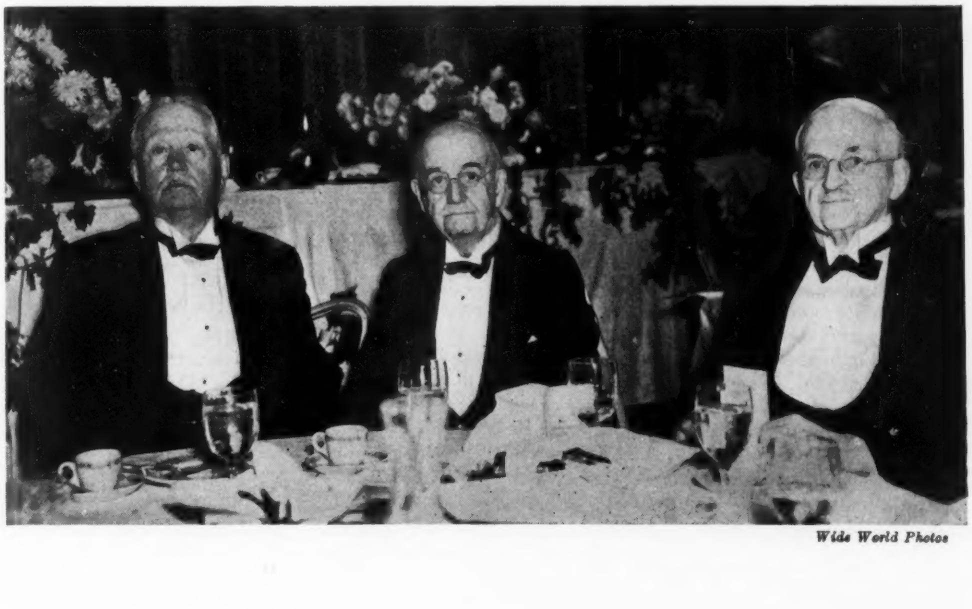
The complete list of the 1937 Fifty-Year Medalists is as follows: George S. Barnum, who started with The Bigelow Co. as an office boy in 1871 and today is president and treasurer of the company; John T. Boyd, who finished at the Polytechnic College of Pennsylvania in 1876, began his engineering career as an apprentice with the Pennsylvania Railroad, and is today engaged as a consulting engineer; Hugh V. Conrad, who served as an apprentice with the Baldwin Locomotive Works, did considerable work on air compressors, and is now retired from active practice; Louis G. Engel, who graduated from Columbia College in 1880, did engineering work in many fields, and is still active; Winfield S. Huson, who got his engineering training in the shop, did considerable engineering work in printing and its allied fields, and nowadays is living the life of a retired gentleman; Charles L. Huston, who finished Haverford College in 1875, went into his father's business of steel manufacturing, and is today vice-president of the Lukens Steel Company; Henry P. Merriam, who finished M.I.T. in 1886, worked himself up from the drafting board to the top, and is now living a life of leisure in Hubbardstown, Mass.; Wm. H. Peirce, who started his career in Baltimore, made good, and became president of the Baltimore Copper Smelting and Rolling Co., and now is living a life of retirement in a suburb of Baltimore; and A. Parker Smith, who got his engineering degree from Lehigh in 1884, then after a short period in the U. S. Patent Office, received a law degree from Georgetown in 1888, and from that day on has practiced patent law.

As toastmaster, President Herron initiated the addresses by a brief discussion of "Professional Unity," excerpts from which will be found on page 8 of this issue.

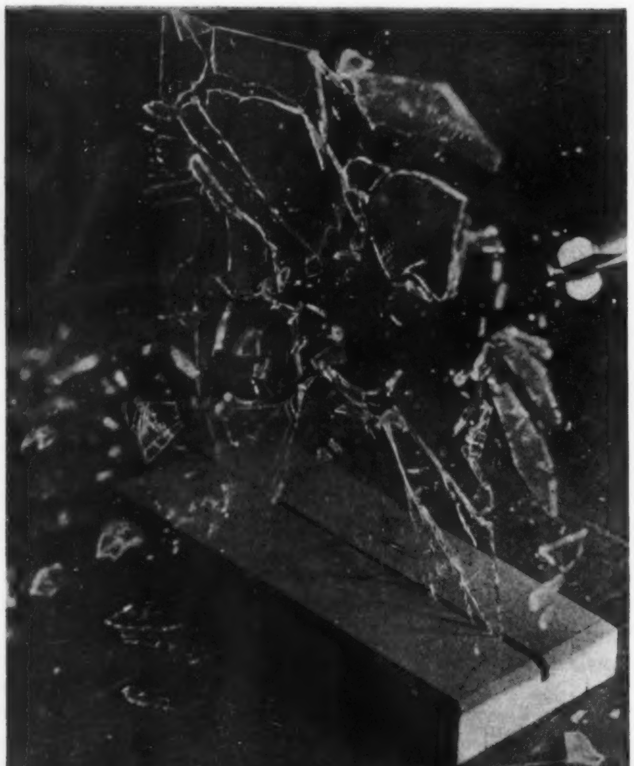
ADDRESS BY FLOYD PARSONS

In an address "What's Business Coming to?" Floyd Parsons, vice-president and editorial director Robbins Publishing Company, New York, N. Y., impressed on his audience the seriousness of the present business recession. He dealt with the marvelous accomplishments of science and engineering in recent years, citing specific instances of inventions and new industries,

FIFTY YEARS AGO WINFIELD S. HUSON, LEFT, AND JOHN T. BOYD, CENTER, APPLIED FOR MEMBERSHIP IN THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. THEY WERE HONORED AT THE ANNUAL DINNER OF THE SOCIETY AT THE HOTEL ASTOR ALONG WITH EDWARD N. TRUMP OF SYRACUSE, A FIFTY-FIVE YEAR MEMBER



Wide World Photos



END OF PROJECTILE THAT SHATTERED THE GLASS CAN BE SEEN AT THE RIGHT—ONE OF THE HIGH-SPEED PHOTOGRAPHS SHOWN BY R. MERWIN HORN ON HONORS NIGHT

and pointing out how rapidly life is being altered by scores of new machines, new materials, and new methods.

"Let no one doubt," he said, "that if American business is given a chance, it will immediately become a boundless field of excitement and adventure. However," he added, "although trade and industry are ready to go they are restrained by fear of the government and what it will do." Continuing, he said in part:

We have just witnessed the sharpest decline in the industrial production index that has ever occurred in the same length of time. This would seem to mean that you cannot make prices, profits, and business conform to preconceived patterns. Unfortunately, in Washington some of the federal officials close to the throne are declaring that the current slump puts capitalism, not the Administration, on the spot.

These spokesmen say that if industry does not pick up the ball and push ahead right away under present discouraging conditions, the Administration will be justified in seizing the opportunity to announce that another major emergency exists, and that the government must take over and nationalize certain major industries such as the railroads, the utilities, and the insurance companies.

This would mean the socialization of the government, a long-sought goal by present reformers, and would permit the revenues from the nationalized industries to be made available for an unprecedented volume of pump-priming. Figures have been complied to show what this revenue would total.

Business on the other hand, has a different point of view. Many believe that this is Mr. Roosevelt's last good opportunity to redeem himself. They say that what he does in the next few months to remedy the present situation will far overshadow in the eyes of future historians any of the mistakes he made in the past.

Mr. Roosevelt's crisis was not in March, 1933—it is today. In 1933 he was dealing with a nation that was thoroughly deflated and ready for recovery. Now he is dealing with a country filled with class hatreds, plagued by misconceptions, and pestered by groups and clans that have acquired access to federal funds.

The causes of the present recession in business are different from those in the past. Today, about 20 per cent more of the national income is routed into government treasuries than ever before. This income is not put to use where it will create more capital. Our present tax system operates in several ways to discourage both savings and enterprise. Saving by corporations is penalized.

We have wage agreements now that are inflexible and run over considerable periods of time, and this means the arbitrary fixing of hours and wages instead of their being fixed by natural laws. This definitely impairs the self-balancing ability of the economic system, and the result is sure to be disparities in prices and upsets in trade movements.

Also, it is true that the government appears to be for and against higher costs at one and the same time. It favors higher transportation rates, higher wages, shorter hours, and higher prices for such basic commodities as coal. Under the new rules coal mines will receive about 10 cents more a ton for their product; but the railroads will have to spend $25,000,000 more for fuel. Other industries are also shouldered with larger costs, and this is so serious that several utility and chemical companies are considering buying captive coal mines to save money.

Undoubtedly there are bright spots in the picture. The rapid liquidation of inventories is one. Numerous movements in the direction of uniting the forces of business under a leadership that will command universal respect is another.

It is natural that experienced business leaders should be fearful of a program that has reduced the working week in America nearly 20 per cent in six years, whereas it required 29 years previously to reduce it 15 per cent. The Brookings Institution and other sound authorities now declare that our major industries must produce more than they ever did before if we are to restore the per capita level of production and consumption prevailing in 1929. These students of the current problem also assert that anyone who now favors a further general reduction in the length of the working week with conditions as they are, is unwittingly favoring and fostering a lower standard of living.

What business is coming to—God only knows. The present slump may turn out to be a major depression ushering in Fascism instead of merely a short recession. Great damage has been done to the nation and we cannot laugh off the creation of a huge bureaucracy; the building up of an army of people who not only expect, but demand federal assistance, and the waste of billions of dollars of public funds.

HOOTON SPEAKS ON "APES AND ENGINEERS"

In an entirely different vein, Earnest A. Hooton, professor of anthropology and curator of the Peabody Museum, Harvard University, Towne Lecturer for 1937, delivered an address entitled, "The Simian Basis of Human Mechanics, or Ape to Engineer." His thought-provoking and brilliant address traced the evolution of the human species from its prehistoric past, showed how by adaptation to his environment man had succeeded in becoming "lord of the fowl and the brute," and how through the introduction of science and technology in the conquest of environmental hazards man had not only stopped sweating but thinking. His dark view of the effect on the virility and intelligence of the human race of the so-called benefits of the machine age provided much food for thought. The address will be found on pages 42 to 46 of this issue.

At the conclusion of Professor Hooton's address Mr. Herron turned the audience over to Francis Hodgkinson who announced the plans for the reception and dancing. In the laurel room, President Herron, President-Elect and Mrs. Davis, and Secretary and Mrs. Davies greeted the members and guests. Much regret was expressed that Mrs. Herron had been unable to attend the meeting.

Dancing, which followed the dinner and continued until 2 o'clock, provided its novelties. With good music as an urge to light-footedness, and an excellent example staged by pro-

fessional dancers from the Arthur Murray dance studios, everybody seemed to forget Professor Hooton's dark forebodings and indulged in one of the most ancient and characteristic of man's social expressions. Informality, to overcome the austerities of reserve and bashfulness, soon put every one at ease, and such dances as the "Paul Jones" further contributed to gaiety and unconventionality.

TECHNICAL SESSIONS CROWDED

Lest it be thought that the 1937 Annual Meeting was utterly devoid of serious discussion of technical papers, let the reader turn to issues of the Transactions and MECHANICAL ENGINEERING that appeared in the fall and read for himself some of the excellent contributions to the more solid nutriment offered by the program. In three days and on two evenings, 35 sessions were held, 99 papers were presented, and more than fifty technical committees met. Too much space would be required to abstract even briefly the wealth of material presented during the week. Many of the papers have been published. Discussion on these will appear later as soon as it can be prepared, and other papers, received too late for publication in advance of the meeting, are scheduled for early issues of MECHANICAL ENGINEERING and the Transactions.

Following a practice that has met with great success at recent Society meetings, technical sessions were held on Monday and Thursday evenings, thus not only relieving a congested daytime schedule but also providing opportunity for those unable to attend during the day to taste the flavor of, and make a contribution to, the more serious part of the week's events. Two sessions were scheduled for Monday night, one under the auspices of the Management Division and the other sponsored by the Machine Shop Practice Division. The Management Division's session inaugurated a series of similar gatherings which continued throughout the next few days, all devoted to timely subjects. None of the papers read at these sessions had been published in advance, and hence a brief summary of all of the papers and addresses has been assembled and may be found on pages 84 to 86 of this issue.

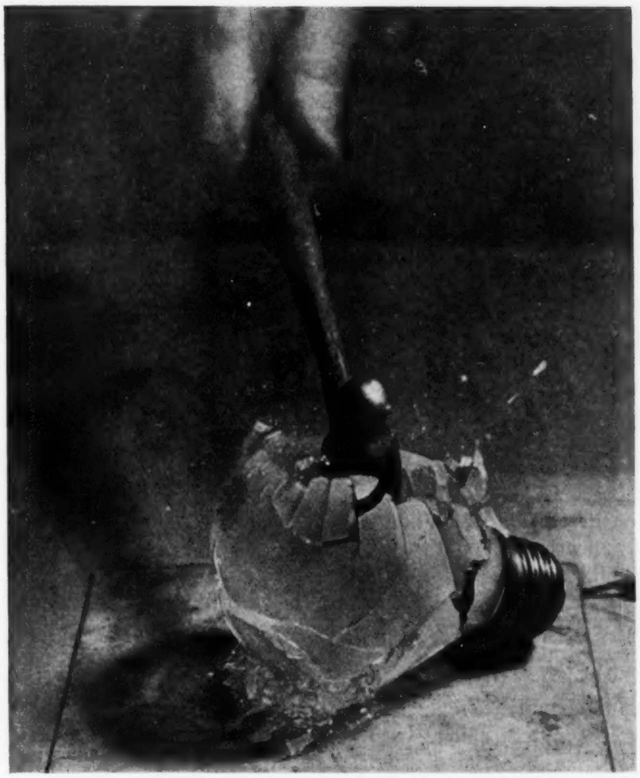
Tuesday morning's schedule provided sessions on elasticity, mechanical springs, plastics, sanitation, and drying. In the afternoon the discussion of plastics was continued and in addition critical-pressure steam boilers, power, and processes were discussed. On Wednesday morning groups of papers on high-temperature joints, heat transfer, and the printing of textiles were read. A symposium of international significance, devoted to the subject of water hammer, commenced on Wednesday afternoon, and was continued on Thursday morning and afternoon, with special reference to hydroelectric plants and water works, respectively.

With a filled auditorium, the Power Division sponsored a panel discussion of new high-pressure, high-temperature power stations. At least ten of the more significant "topping" plants were discussed by engineers connected with them, from the points of view of solution of unusual construction problems, capacity and efficiency performance, troubles with equipment, and starting-up procedure. Discussion was frank and eagerly listened to by the audience. Although none of the contributions had been published in advance of the meeting, the Power Division is at work upon a plan to submit the discussions for publication at a later date.

Also on Wednesday afternoon were sessions on management, vibration, and process control.

Fuels, safety, and lubrications were discussed at a session held on Thursday morning, and in the afternoon strength of materials, safety, fuels, lubrication, and apprentice training.

On Thursday evening the Oil and Gas Power Division presented papers on Diesel-electric switching locomotives and the friction of reciprocating engines; the Aeronautic division a progress report for 1937, and papers on welding and inert gases in reducing aviation hazards; and the Railroad Division a report on air conditioning of passenger cars, an extensive study of railroad-axle and locomotive crankpin design, and the progress report for 1937, begun in the December issue of MECHANICAL ENGINEERING and concluded this month.



NOTE THE UNDERSIDE OF THE LIGHT BULB BREAKING UNDER THE IMPACT OF THE HAMMER—ONE OF THE HIGH-SPEED PHOTOGRAPHS SHOWN BY R. MERWIN HORN ON HONORS NIGHT

TECHNICAL COMMITTEES' DISCUSSIONS

The usual large attendance and enthusiastic discussions of the problems presented on the agenda characterized the technical committees' meetings which were held coincidentally with the technical sessions. Fifty-three meetings were held, research, 13; standards, 25; power test codes, 7; safety, 6; boiler code, 1; and advisory board on standards and codes, 1. The total attendance at these meetings was 701.

RESEARCH

The research sessions were opened on Monday evening with the dinner meeting of the standing committee. This year the committee revived an old custom and invited the officers of the 22 special research committees and the members of the Council to attend. Thirty-nine sat down to dinner at 6:15 in the Engineers' Club. Following the meal Chairman N. E. Funk presided and first introduced the other members of the Research Committee, E. G. Bailey, H. A. Johnson, and L. W. Wallace. J. E. Gleason was not able to attend. The advisory members of the main committee, Albert Kingsbury, A. D. Bailey, R. J. S. Pigott, and A. E. White, were then presented, with the two members of the Council, K. H. Condit and Alfred Iddles, who were present. Following the usual round of self-introductions

Mr. Funk requested all present to take part in a general discussion of a patent policy for the Society. Copies of model agreements (1) between the Society and a research agency and (2) between a research agency and a research worker had been previously distributed by mail to these officers of the special research committees. The discussion was general and at times spirited. The opinions expressed will be studied by the members of the Research Committee while redrafting the agreements.

At this point a number of those present withdrew to attend one or the other of the technical sessions scheduled for that evening. The main committee continued in session until 10:30, transacting routine business. Mr. Funk was reelected chairman of the committee for the coming year and the Secretary announced that J. E. Gleason, who had served out the last two years of Dr. C. R. Richard's term, had been appointed for a full five-year term by President-Elect Davis.

Secretary LePage reported that the outstanding accomplishment during the year was the completion and publication of the fourth edition of "Fluid Meters—Part I, Their Theory and Application."

Thirteen special and joint research committee meetings were held during the five days of Annual Meeting week. The committee on fluid meters, R. J. S. Pigott, chairman, led off on Tuesday morning with a well-attended meeting. Twenty-six were present and the time was spent primarily in receiving up-to-the-minute reports of the research on flow nozzles which is in progress under the auspices of the committee in eight laboratories situated at the National Bureau of Standards, University of California, Cornell University, Lehigh University, Massachusetts Institute of Technology, University of Oklahoma, Ohio State University, and the University of Pennsylvania. That same morning the committee on mechanical springs sponsored a technical session and in the afternoon held its annual meeting. Secretary C. T. Edgerton presided at the session and the following two papers were presented: "Progress Report of Subcommittee on Heavy Helical Springs," by C. T. Edgerton, and "Spring Materials," by D. J. McAdam.

The special research committee on cutting of metals began its week's activities by sponsoring jointly with the Machine Shop Practice Division a technical session held on Monday evening. M. F. Judkins, chairman of the subcommittee on metal-cutting materials, read one of the two papers. Its title was "The Grinding and Maintenance of Sintered Carbide-Tipped Tools." Dr. E. J. Abbott presented the second paper entitled "Profilometer for the Rapid Measurement of Surface Roughness." The metal-cutting materials subcommittee held a meeting on the following Tuesday morning at which ten were present. This was followed by a joint luncheon meeting of the special research committee on cutting of metals and the subcommittee on cutting fluids.

An all-day meeting of the committee on strength of vessels under external pressure, W. D. Halsey, chairman, was held on Wednesday and the committee on critical-pressure steam boilers, A. A. Potter, chairman, met on Thursday morning to review the progress made during the year in its experimental research at Purdue University.

This year the joint research committee on boiler-feedwater studies held a joint technical session with the research committee on critical-pressure steam boilers on Tuesday afternoon. As usual, this session was very popular and the audience crowded to the doors the room assigned to it. Approximately 250 were present. E. G. Bailey, a member of the main Research Committee, presided, and J. B. Romer acted as recorded. The four papers presented were: "Investigation of the Oxidation of Metals by High-Temperature Steam," by A. A. Potter, H. L. Solberg, and G. A. Hawkins; "Intercrystalline Cracking of Steel in Aqueous Solution" and "Protecting Steel Against Intercrystalline Attack in Aqueous Solutions," by W. C. Schroeder, A. A. Berk, and R. A. O'Brien; and "Decomposition of Sodium-Sulphite Solutions at Elevated Temperatures," by F. G. Straub, H. F. Johnstone, and W. O. Taff. On Wednesday afternoon the executive committee of the first-named committee, C. H. Fellows, chairman, held its meeting. Thirteen were present. On Monday evening, the subcommittee on effect of solution composition on the cracking of boiler metal, J. H. Walker, chairman, held its meeting, and had an attendance of sixteen.

The new special research committee on lubrication sponsored two technical sessions held Thursday morning and afternoon. L. J. Bradford presided at the former and B. L. Newkirk, acting chairman of the research committee, presided at the latter session. The following five papers were presented and discussed at these sessions: "Thrust Bearings," by F. C. Linn; "Tests of a $7 \times 10^1/_2$ in. Bearing at 3600 Rpm," by L. M. Tichvinsky; "Surface Finish," by Stewart Way; "Running-In Characteristics of Some White-Metal Journal Bearings," by S. A. McKee and T. R. McKee; and "The Influence of Adsorbed Moisture Films on the Coefficient of Static Friction Between Lubricated Solid Surfaces," by W. E. Campbell and E. A. Thurber.

At the meeting of this research committee, which was scheduled for Friday morning, luncheon, and afternoon, the principal item of business was the report by Chairman G. B. Karelitz, H. A. Everett, and R. C. Geniesse on the "General Discussion on Lubrication and Lubricants," held in London under the auspices of The Institution of Mechanical Engineers, Oct. 13 to 15, 1937. These gentlemen represented the committee and the Society on this occasion and returned with an enthusiastic story of valuable technical contributions to this subject.

The special research committee on condenser tubes, A. E. White, chairman, held its usual luncheon meeting on Thursday at which 35 reported. Vice-Chairman Bert Houghton was among those present.

Eight persons attended the last research committee meeting of the week on Friday afternoon. This was a meeting of the subcommittee on metal-cutting data, L. P. Alford, chairman, which has recently completed the manuscript of a manual on the cutting of metals with single-point tools. During the past year this manuscript has been submitted to certain interested groups for critical review. At this meeting definite plans for its final editing and publication were made.

The Joint Research Committee on the Effect of Temperature on the Properties of Metals, H. J. French, chairman, did not sponsor a session this year as has been its custom in the past. It did, however, contribute a paper to the high-temperature joints session on "Effect of Temperature Variation on the Creep Strength of Steels," by E. L. Robinson, a member of the joint committee.

STANDARDS

Again the A.S.M.E. Standards Luncheon was an important feature of the week of 25 standards committee meetings. It was held on Wednesday noon and was attended by 56 chairmen and secretaries of standards committees for which the Society is sponsor or joint sponsor.

Walter Samans presided as chairman of the A.S.M.E. Standardization Committee and introduced the other four members of the committee, J. E. Lovely, O. A. Leutwiler, W. C. Mueller, and A. L. Baker, and C. P. Bliss and A. M. Houser, two of the committee's advisory members. The officers of the committees

represented then related in turn the accomplishments of their committees during the year.

Routine business occupied most of the Standardization Committee's attention during the meeting held before the luncheon. Walter Samans was reelected chairman for another year. Alfred Iddles and Walter Samans were nominated for appointment as A.S.M.E. representatives on the Standards Council of the American Standards Association for the two-year period 1938–1940, with A. L. Baker and C. B. LePage as alternates for the year 1938. At this meeting and at the luncheon, Secretary LePage announced that five standards had been completed and submitted during 1937 to the American Standards Association by some of the 32 sectional committees for which the Society is sponsor or joint sponsor.

As usual, the technical committees organized by the sectional committee on small tools and machine-tool elements (B5), W. C. Mueller, chairman, held a group of meetings extending from Monday to Thursday. Nine attended the meeting of committee No. 10 on forming tools and holders early Monday morning, and 13 a meeting of committee No. 20 on reamers, W. C. Mueller, chairman, that afternoon. A meeting of technical committee No. 6 on designations and working ranges of machine tools, John Haydock, chairman, was also held on Monday morning. Tuesday morning found 15 men assembled for a meeting of committee No. 3 on machine tapers, F. S. Blackall, Jr., chairman. Technical committee No. 8 on jig bushings, F. S. Walters, chairman, held its meeting on Tuesday afternoon, as did committee No. 2 on tool posts and tool shanks and committee No. 17 on nomenclature, O. W. Boston, chairman.

Wednesday afternoon sectional committee B5 held its meeting at which reports were received from all of the 19 technical committees which had been active during the past year. In this connection, announcement was made of the recent approval by the three sponsor societies of the proposed American Standard for twist drills developed by technical committee No. 7. It was decided that the chairman should appoint a committee to determine the desirability of continuing the work of technical committee No. 14 on electric-welding dies and electrode holders in the face of a waning interest in this project.

The following morning technical committee No. 12 on cut and ground thread taps, C. M. Pond, chairman, held a meeting at which the proposed revision of the American Standard for this product, B5e-1930, was carefully reviewed and discussed.

Important decisions were made at a meeting of the subcommittee on tolerance systems, R. E. W. Harrison, chairman, of the sectional committee on allowances and tolerances for cylindrical parts and limit gages, B4, held on Tuesday morning. Fifteen attended the meeting. That afternoon a particularly well-attended meeting was held by subcommittee No. 3 on symbols for mechanics, R. E. Peterson, chairman, of the sectional committee on letter symbols and abbreviations for science and engineering. At this time the committee discussed and approved certain changes and additions for inclusion in the present American Standard on symbols for mechanics, structural engineering and testing materials, Z10a-1932.

Five other large and important sectional committees held well-attended meetings during the week. The first was held on Wednesday morning when committee B46 on the classification and designation of surface qualities met to receive and discuss the report of its executive committee which had held five meetings during the year including a meeting the previous afternoon. Following prolonged discussion, the executive committee was instructed to duplicate its report and to distribute copies of it to the members of the sectional committee for comment. At the same time the committee empowered the executive committee to continue its research on the classification of surface qualities. The sectional committee received the resignation of Col. H. K. Rutherford owing to his transfer to Washington and to another line of work. It was accepted with regret and J. R. Weaver was elected chairman.

Wednesday afternoon Prof. A. E. Norton called the sectional committee on bolt, nut, and rivet proportions, B18, to order in the Board Room of the A.I.E.E. Twenty-four answered to the roll call and the committee proceeded to discuss corrections and changes in the printer's proofs of the revision of the American Standard for wrench-head bolts and nuts and wrench openings, B18.2-1933, which had been mailed to its members in advance of the meeting. At the end of the discussion the revised standard, after editing in line with the decisions made at this meeting, was ordered to letter ballot of the sectional committee. A similar procedure was followed in connection with the proposed revision of the American Standard for round unslotted-head bolts, B18e-1928, resulting in a similar action. Early in the meeting W. P. Acres presented his resignation as secretary. This was accepted with regret and the place filled by the election of W. C. Stewart.

For some months prior to Annual Meeting week subcommittee No. 3 on steel flanges and flanged fittings had worked hard to prepare material for the consideration of the sectional committee on standardization of pipe flanges and fittings, B16, at its meeting on Thursday morning, December 9. Chairman C. P. Bliss was in the chair and A. M. Houser presented the report of subcommittee No. 3, section by section. This proposed revision of American Standard B16e-1932 is to contain a considerable number of important additions among which are (1) welding-neck flanges, (2) flanges for ring joints, (3) recognition of the use of alloy-steel castings and forgings, and (4) inclusion of dimensions for 2500-lb flanges and flanged fittings. After a full discussion the proposed revision was approved subject to corrections and changes presented at the meeting and was ordered to letter ballot when a set of revised printer's proofs are made available to each member of the committee.

A. M. Houser, chairman, subcommittee No. 1 on cast-iron flanges and flanged fittings, reported that in the letter ballot of the sectional committee on the proposed revision of the American Standard B16a-1928 seven negative ballots had been cast. Copies of the comments of the members casting these ballots and of a few others who had voted affirmatively were sent to the members of subcommittee No. 1 in advance of the meeting of that subcommittee held on Wednesday morning. The points raised by these members of the committee were discussed at length, but since no decisions were reached, Chairman Houser was requested to correspond with them in an attempt to compose the differences in opinion.

The fifth sectional committee holding a meeting during the week was committee B2 on pipe threads, A. S. Miller, chairman. Thirty members and interested visitors attended this meeting which was the first the committee had held in a number of years. The business of the meeting consisted in the discussion of the material contained in the printer's proof draft of the revision of American Standard B2-1919. This proposed revised draft covers in addition to new material on the taper pipe-thread standard a number of tables and the corresponding text setting the specifications for the various types of straight pipe thread now employed in industry. Considerable time and effort have been expended in gathering together and editing these data and it was agreed that their addition to the present standard in its revised form would be of inestimable value to the industries concerned. The reports of the two subcommittees presented by Chairman S. B. Terry on taper pipe threads and by A. M. Houser on straight pipe threads were approved in prin-

"HUNTING 'GAS' IN A COAL MINE," PHOTOGRAPH BY J. A. LUCAS SHOWN AT PHOTOGRAPHIC EXHIBITION AT ANNUAL MEETING

ciple and two small editing committees were appointed to revise the text of each section: S. B. Terry, C. W. Bettcher, and A. F. Breitenstein for the taper thread, and P. V. Miller, C. C. Winter, and J. H. Williams for the straight thread. When this reediting process is completed the standard is to be submitted to the members of the sectional committee for vote by letter ballot.

The largest attendance at a technical-committee meeting during the week, 50, was that at the meeting of the sectional committee on pressure piping, E. B. Ricketts, chairman. This meeting had been called for the purpose of discussing the need for the revision of the American Standard code for pressure piping (B31.1-1935) which was approved and published in 1935. This code has been very well received by industry, and its representatives who attended this meeting were unanimous in their recommendation that certain sections of the code, especially the welding section, be revised in line with the recent developments in this field. To insure an orderly procedure the personnel of the eight subcommittees was reviewed and certain changes and additions were made. W. D. Halsey was elected to head the subgroup of subcommittee No. 8 which is to revise the text of the code dealing with welding. The chairmen of the eight subcommittees are as follows: Sabin Crocker, subcommittee No. 1 on plan and scope and editing; Alfred Iddles, subcommittee No. 2 on power piping; J. S. Haug, subcommittee No. 4 on gas and air piping; A. H. Baer, subcommittee No. 5 on refrigerating piping; A. D. Sanderson, subcommittee No. 6 on oil piping; F. H. Morehead, subcommittee No. 7 on piping materials and identification; Ludwig Skog, subcommittee No. 8 on fabrication details; and D. S. Boyden, subcommittee No. 9 on district heating.

The Society entertained three guest committees on Friday morning. The American gage-design committee, J. O. Johnson, chairman, and H. W. Bearce, secretary; A.S.T.M. subcommittee 22, section on castings, J. J. Kanter, temporary chairman; and A.S.T.M. subcommittee 22, section on pipe, A. E. White, chairman. Twenty attended the first-named committee meeting which devoted its three-hour period largely to a discussion of characteristics of standard test plugs.

POWER TEST CODES

Six of the individual code committees and the main committee on power test codes held meetings within the week. The committee on steam turbines, C. H. Berry, chairman, led off on Tuesday morning with a well-attended breakfast meeting. Thirteen were present and the final touches were put on the revision of this important test code which has been in progress for the past five years. F. Hodgkinson and W. E. Caldwell with Chairman Berry have worked hard during the year to complete the editing of this final draft. Committee No. 4 on stationary steam-generating units, E. R. Fish, chairman, met after breakfast to begin the revision of the test code for stationary steam-generating units. The committee on hydraulic prime movers No. 18, E. C. Hutchinson, chairman, held two sessions that same day. Ten members were present at each session and the time was spent in a careful review of the printer's proofs of the proposed code which had been distributed to the members prior to the meeting.

Committee No. 21 on dust-separating apparatus, M. D. Engle, chairman, made good progress at its meeting held Wednesday afternoon. The first draft of this test code which had been written and distributed prior to the meeting, was gone over thoroughly. Committee No. 12 on condensers, water-heating, and cooling equipment, Geo. A. Orrok, chairman, met on Thursday afternoon and approved the revision of the test code for condensing apparatus. The sixth code committee, that on testing of fans, No. 10, met on Friday afternoon and discussed a plan for the rewriting of the material which has been previously reviewed by the members of the committee in various forms. Prof. M. C. Stuart is chairman of this committee.

The meeting of the main committee was held this year in the Board Room of the American Society of Civil Engineers. Thirty-seven were present and Chairman Francis Hodgkinson was in the chair.

Many items of routine business were transacted including a number of additions to the personnel of the several committees in this group. C. B. Campbell was nominated for appointment to committee No. 6 on steam turbines, C. R. Houghton to committee No. 9 on displacement compressors and blowers, I. M. Stein to committee No. 19 on instruments and apparatus, and Secretary LePage announced the appointment of John Allhusen as the junior observer by President-Elect Davis.

Chairman Hodgkinson reported for the I.E.C. secretariat on prime movers. He announced that a plenary meeting of the International Electrotechnical Commission was to be held in England in June, 1938, and that meetings of I.E.C. advisory committees, No. 4 on hydraulic turbines, No. 5 on steam turbines, and No. 19 on internal-combustion engines were contemplated. He stated, however, that no definite plans for the proposals which would be presented at these meetings or for the representation of the U. S. National Committee of the I.E.C. had been made.

Reports of all active code committees were then called for, responses being made by Chairman R. J. S. Pigott for No. 2 on definitions and values; Chairman W. J. Wohlenberg for No. 3, fuels whose report was supplemented by a comprehensive report by L. Elliott, member of the main committee, who reviewed the large number of comments resulting from the distribution of the preliminary draft of the test code for gaseous

fuels; Chairman E. R. Fish for No. 4, stationary steam-generating units; Chairman C. H. Berry on steam turbines; Chairman Paul Diserens for No. 9, displacement compressors and blowers; Chairman M. C. Stuart for No. 10. fans; Chairman Geo. A. Orrok for No. 12, condensing apparatus; W. M. White for Chairman E. C. Hutchinson on hydraulic prime movers; and by W. A. Carter for Chairman Hirshfeld on instruments and apparatus.

Four of these committees reported that the revision of their codes were now completed and finally revised copies of them were in the hands of Secretary LePage or would be placed there shortly. The test codes referred to are those on (1) steam turbines, (2) condensing apparatus, (3) hydraulic prime movers, and (4) flow measurement by means of standardized nozzles and orifice plates. While the last-named report is the work of a special subcommittee of which W. A. Carter is chairman, it will eventually form a chapter of part 5 on measurement of quantity of materials of instruments and apparatus, the supplementary material developed for the users of the twenty-one test codes and auxiliary apparatus.

SAFETY

Two technical sessions and five committee meetings is the record made by the A.S.M.E. Safety Committee, H. H. Judson, chairman, at the 1937 Annual Meeting.

The session held on Thursday morning was entirely under its auspices. D. L. Royer, one of its members, presided and the following two papers were read and discussed: "The Application of Safety in Mechanical Production," by E. W. Martin, and "Adequate Job Training for Accident Prevention," by Glenn Gardiner. The second session held that same afternoon was sponsored jointly by the Machine Shop Practice Division and the Safety Committee. J. R. Weaver, secretary of the division, presided at this session and the two papers presented by R. R. Meigs and A. W. Luce, respectively, were well received and provoked a large amount of discussion. The first was entitled "The Application of Dust-Control Principles to Foundry Operations," and the second "Safety in Machine Design."

All five of the subcommittees of the sectional committee on a safety code for conveyors and conveying machinery, D. L. Royer, temporary chairman, held meetings during the week and laid the foundation for the development of the several sections of this new national safety code. Prof. George W. Barnwell, temporary secretary of the sectional committee, attended all of these meetings and helped the subcommittees to organize and to get started in the right direction.

BOILER CODE

While the Boiler Code Committee held its regular meeting on the Friday before the Annual Meeting week, its subcommittee on the care of power boilers, F. M. Gibson, chairman, held a meeting on Tuesday morning. At this meeting a number of subjects of vital interest to boiler users were discussed at length, but no final decisions were reached.

In addition, certain members of the Boiler Code Committee took an active part in the proceedings of the special research committee on vessels under external pressure, W. D. Halsey, chairman, and the Standards subcommittee on welding of branch connections.

WOMAN'S AUXILIARY PROVIDES VARIED PROGRAM

The following report of the activities that engaged the attention of the women visiting New York in connection with the 1937 A.S.M.E. Annual Meeting was prepared by Miss Burtie Haar, chairman, Publicity Committee:

One hundred and eighty ladies enjoyed the Thirteenth Annual Meeting of the Woman's Auxiliary, one of whom, Mrs. A. J. Schwartz, of Washington, D. C., has attended every annual meeting of the A.S.M.E., except two, since the founding of the Society. The general chairman, Mrs. C. B. LePage, arranged a most interesting program which started with an informal dinner and cards at the Engineering Woman's Club under the chairmanship of Mrs. Crosby Field.

"SKI TRAIL," PHOTOGRAPH BY E. H. HULL SHOWN AT PHOTOGRAPHIC EXHIBITION AT ANNUAL MEETING

Tuesday morning at the Engineering Woman's Club, the annual business meeting of the Auxiliary was conducted by the retiring president, Mrs. Wm. H. Boehm. Mrs. Roy V. Wright, chairman of the Educational Fund, read the report which granted eight loans this year, thereby making 38 scholarships given to students of 15 different universities and colleges in its 13 years of existence. At this meeting a resolution was passed to add more local sections to the Auxiliary with representation on the Executive Board. The following officers were elected for 1938: President, Mrs. G. W. Farny; first vice-president, Mrs. J. Ansel Brooks; second vice-president, Mrs. Calvin W. Rice; third vice-president, Mrs. R. T. Kent; recording secretary, Mrs. Chas. E. Gus; corresponding secretary, Mrs. J. N. Landis; treasurer, Mrs. A. H. Morgan.

The high light of the Annual Meeting was the annual luncheon held in the Neptune Room of the Hotel Pierre for which Mrs. G. L. Knight, the chairman, is to be thanked. This was so well-attended that it doubled the attendance of last year's luncheon. After presenting the retiring president, Mrs. W. H. Boehm, with a token of appreciation and introducing the incoming president, Mrs. G. W. Farney, the mistress of ceremonies, Mrs. R. V. Wright, announced Miss Ethel Traphagen, of the Traphagen School of Fashion, who conducted a pageant of East Indian costumes. The students displayed the costumes from various sections of India, with the appropriate necklaces,

MRS. W. H. BOEHM MRS. G. W. FARNEY

RETIRING AND INCOMING PRESIDENTS OF THE WOMAN'S AUXILIARY TO THE A.S.M.E.

rings, and anklets. Miss Traphagen told of her interesting experiences in buying the dresses and the handwrought jewelry.

Tuesday evening the ladies attended Honors Night and the unveiling of the bronze tablet to the founder of the Auxiliary, the late Calvin Winsor Rice. At his suggestion the Educational Fund was created. Never was Mr. Rice too busy to aid the Auxiliary and his memory will always be an inspiration to it.

The chairman of excursions, Mrs. J. H. R. Arms, arranged a tour of Fifth Avenue, stopping first at Corning Glass Works which was so interesting it was hard to leave to visit the model apartment in Rockefeller Apartments. This was also interesting and attractive. Luncheon was served at the restaurant and then the group visited the Georg Jensen Handmade Silver, Inc., store. Miss Kane told of the lifework of Georg Jensen and showed beautiful museum pieces with accessories. The last stop was at W. & J. Sloane's "The House of Years."

In the evening at the Hotel Astor the ladies attended the Presidents' Reception and Annual Dinner, with Mrs. H. V. Coes, chairman of arrangements.

Thursday morning, an illustrated talk on "Old New York" was given at the Museum of the City of New York, and Cooper Union's Museum for Arts of Decoration was viewed, as well as the Theodore Roosevelt Home.

Mrs. F. M. Gibson, chairman of registration has reported that all the visitors registered and Mrs. C. E. Gus, chairman of program, provided for all their needs.

The Annual Tea at the Engineering Woman's Club, Mrs. R. V. Wright, chairman, ended the 1937 program of events for the Woman's Auxiliary to the A.S.M.E.

ENGINEERS DISPLAY PHOTOGRAPHIC TALENT

Throughout the meeting, a display of photographs by engineers was exhibited in the north corridor of the auditorium gallery in the Engineering Societies Building. The exhibit was under the sponsorship of the photographic group of the junior members of the Metropolitan section and C. G. Humphreys acted as chairman of the committee in charge of the display. Many visitors were attracted by the variety of the work and subject matter presented in the photographs, which included industrial and technical subjects as well as portraits and landscapes. Through the courtesy of the committee and the photographers, several samples of the work exhibited have been used to illustrate this month's issue. The "candid camera shots" that have been used in this issue were taken by J. F. Guinan and L. J. Levert. Acknowledgment is made with grateful appreciation to the editorial department of the American Institute of Electrical Engineers for the use of the camera with which some of the photographs were taken.

FOR DEAR OLD ALMA MATER

According to a custom that has become popular with engineering-college graduates, ten reunions were held on Thursday evening in various parts of the city.

The Brooklyn Polytechnic Alumni Association met at the Institute, 85 Livingston St., Brooklyn, to listen to a lecture by Dr. E. Lengyel, of the *New York Herald Tribune*, entitled, "Russia Twenty Years After." An annual meeting and smoker followed the lecture.

The Brown Engineering Association dined at Midston House, where Henry M. Wriston, president, Brown University, was the principal speaker.

The annual mechanical-engineering alumni dinner of Columbia University graduates met at the Columbia University Club for dinner to hear Francis Hodgkinson, former chief engineer of the Westinghouse Elec. & Mfg. Co., and at present honorary professor of mechanical engineering at Columbia.

The annual Massachusetts Institute of Technology dinner was held on Friday evening at the Hotel Astor. The speakers were Karl T. Compton, president of the Institute, Senator Thomas Desmond, Gerard Swope, and W. K. Lewis.

Speakers at the University of Michigan Club of New York were Dean Henry C. Anderson, Prof. O. W. Boston, and Prof. A. E. White. The meeting was designated a Cooley-Anderson Honor Night.

The annual "Dean Potter" dinner of Purdue University alumni was held at the Building Trades Club.

Ralph E. Flanders addressed alumni of the Rensselaer Mechanical Engineers at the Building Trades Club.

The annual dinner of the New York Rose Tech Club, alumni group of Rose Polytechnic Institute, was held at the Advertising Club.

Stevens alumni gathered for dinner at the Roger Smith restaurant to hear Professor Davidson, of Stevens Institute of Technology, discuss some aspects of the towing tank and cup races.

The annual reunion dinner of the Worcester Polytechnic Institute Alumni Association was held at the Machinery Club.

INSPECTION TRIPS APPRECIATED BY VISITORS

More than 500 members and guests at the 1937 A.S.M.E. Annual Meeting took advantage of the inspection trips planned for them by the special committee under the chairmanship of R. H. McLain.

Most popular of these trips was that to see the *Normandie*, the world's largest steamship. Opportunity was provided for an inspection of the living quarters of the ship and the engine and boiler room, where 29 oil-burning boilers provide steam for four turbine generators serving the four 40,000-hp propelling motors. Interest in the *Normandie* attracted the women as well as the men, and a total of 175 persons took part in the inspection.

On Tuesday afternoon 29 persons went to the Stevens Institute of Technology, Hoboken, N. J., to look at the experimental towing tank under the supervision of Kenneth S. M. Davidson. Interest in the tank has been keen because it was here that Professor Davidson and his associates tested models of the hull forms proposed for America's cup-defense yacht. Operation of the tank in towing tests was demonstrated.

New high-pressure improvements at the Waterside Station of the Consolidated Edison Company attracted 83 visitors. This station has recently installed the largest superimposed

turbine in operation. Boilers produce 500,000 lb of steam per hour at 1400 lb per sq in. Pulverized coal prepared in unit mills is used for fuel, and the gases are carried away by a stack which rises to a height of 455 ft above the sidewalk level.

A combination trip to the site of the 1939 World's Fair in Flushing Meadow Park and to the Ward's Island sewage-disposal plant where approximately 200,000,000 gal of sewage per day is treated by the activated sludge process brought out 52 persons on Wednesday afternoon.

For those interested in isolated power stations, opportunity was given on Wednesday morning to inspect the power plant of R. H. Macy & Co., New York, N. Y. Macy's is the largest retail department store in the world, and in it is housed the largest private power plant in New York. It has a total capacity of 10,400 hp for the operation of lights, elevators, escalators, water supply, as well as steam for heating, hot water, and restaurant service, and refrigeration for air-conditioning and other purposes. Eighty-four persons availed themselves of the priviledge of enjoying this unique trip.

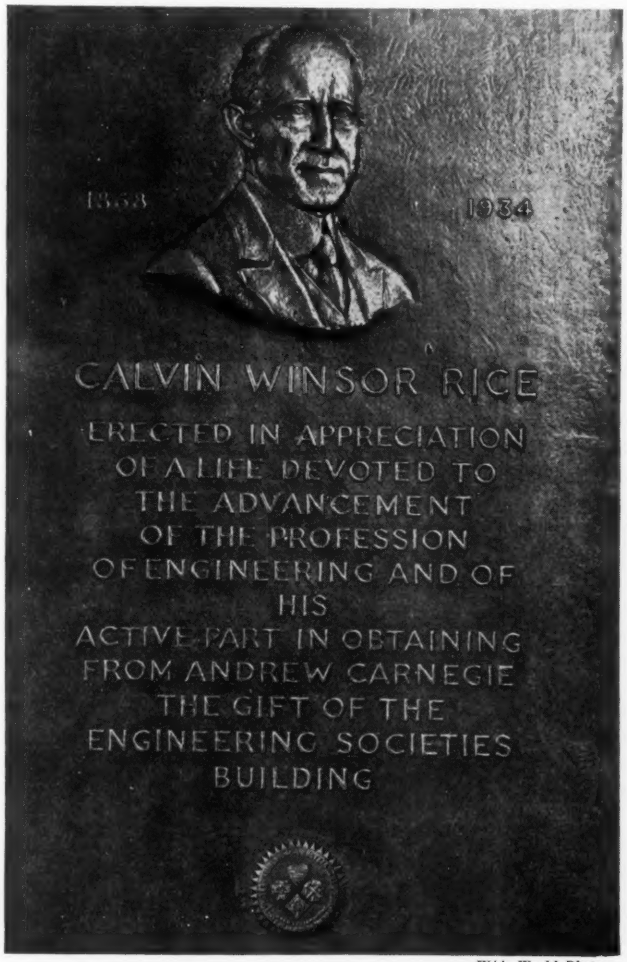
The mechanical service equipment of Rockefeller Center, a group of buildings covering three city blocks and dominated by the 70-story RCA Building, always an attraction to visitors, was inspected by a party of fifty members and guests.

New York's newest vehicular tunnel, connecting that city with Weehawken, N. J., and built under the Hudson River, attracted 39 visitors. This new tunnel, the first of two tubes to comprise the Lincoln Tunnel, was scheduled for opening to traffic Dec. 22, 1937.

About 25 persons accepted the invitation of the American Radiator and Standard Sanitary Corporation to visit its show room at 40 West 40th Street, adjacent to the Engineers Club and the Engineering Societies Building. Here is displayed what is said to be the largest exhibit of heating, ventilating, air-conditioning, and associated building equipment.

MORE MEETINGS COMING

In bringing to a close a rather sketchy résumé of the events of a week in which 2560 engineers and their friends participated, it is appropriate to remind members of the Society that the Council has adopted a program of four national meetings a year because it is realized that New York is not conveniently located to some centers of A.S.M.E. membership. For the benefit of the great number of members scattered over the country national meetings are to be held at Los Angeles, Calif., March 22 to 25, at St. Louis, Mo., June 20 to 24, and at Providence, R. I., sometime in October, 1938.



Wide World Photos

CALVIN WINSOR RICE MEMORIAL PLAQUE

CURRENT PROBLEMS OF MANAGEMENT

Résumé of Papers and Discussion at 1937 A.S.M.E. Annual Meeting

A SERIES of sessions dealing with management problems of today were conducted during the Annual Meeting, Dec. 6 to 10, 1937, under the sponsorship of the Management Division of the A.S.M.E. in cooperation with the Society for the Advancement of Management and the Personnel Research Federation. The sessions arranged by the A.S.M.E. were held at the Engineering Societies Building and those sponsored by the other organizations at the Hotel New Yorker.

More than 100 engineers and business executives from various parts of the country attended a dinner Dec. 6, 1937, at the Midston House, prior to the opening session on time and motion study. No talks were given at the dinner but some lively discussions took place at the various tables.

LABOR'S ATTITUDE TOWARD TIME AND MOTION STUDY

Interest in the evening session held in the Engineering Societies Building after the motion-study dinner was so great that all the 400 seats available were occupied long before the meeting began, and more than 100 late-comers had to stand during the session. Dr. Lillian M. Gilbreth was chairman and opened the meeting by introducing the first speaker, Spencer Miller, Jr., secretary and director, Workers' Education Bureau. He began his talk by stating that "American labor has come of age" and therefore demands that it be consulted on every problem concerning the workers. In some cases, according to Mr. Miller, the unions have taken the initiative in introducing scientific management, and sometimes, time and motion study, in industrial plants by furnishing the company with industrial engineers paid by the labor organizations. Based on a questionnaire sent out by him to 30 national unions, Mr. Miller stated that their attitude on time and motion study has changed, and that they "will cooperate with management under collective agreement, not only in waste elimination, but in enhancing the capacity of industry to produce more goods and services for the welfare of the community."

Then Glenn Gardiner, assistant to the president, Forstman Woolen Co., in propounding the question as to "what consideration should be given to labor's attitude," answered it by agreeing with Mr. Miller on the right of unions to be consulted by management on all problems concerning labor. He urged that management take "guess work" out of motion study so that each and every worker concerned can understand it. Furthermore, he asked Mr. Miller in his official capacity with labor "to promote a better understanding on the desire to understand" the reasons behind motion study and why it is necessary. In conclusion, Mr. Gardiner stated, "Intelligent management recognizes that motion study, as an adjunct to scientific management, is more essential than ever. Motion study helps management to decrease waste, to determine prices of products, and to cut down accidents. But before motion study is used, humanize it, develop a correct manner of approaching employees on its use, and give consideration to those displaced by time and motion study."

Training employees and supervisors in work simplification and, finally, in time and motion study, was described by George Dierstein, Duncan Electric Manufacturing Co. The plan was worked out by Mr. Dierstein and put into operation in a plant employing about 350 employees. Over a period of a year and a half, a group of employees representing about 20 per cent of all the workers was given a thorough training in work simplification with the aid of motion pictures, charts, actual problems selected from the plant, and general discussions. As soon as the group had realized the energy, time, space, and materials being wasted in their own plant, the fundamentals of time and motion study were explained to them. From this point on, with the group disseminating to others what it had learned, it was quite simple to sell time and motion study to all the employees. The group conference method is still continued by the company with much success in settling problems.

MAINTENANCE LUNCHEON

An attendance of fifty marked the Maintenance Luncheon held Dec. 7, 1937, at the Midston House. In the absence of Alfred Vaksdal, J. A. Jacobs acted as chairman of the gathering, which has become a regular feature of the Annual Meeting of the A.S.M.E.

L. C. Morrow, chairman of the Executive Committee of the Management Division, greeted the members present and spoke briefly on the maintenance function from a broad viewpoint. He pointed out that maintenance is a vital part of any program to increase production and lower costs, and that such a program is the only real way in which purchasing power can be increased.

Elimination of waste motion in the maintenance department is the key to holding down maintenance costs in the face of reduced working hours, labor difficulties, higher wages, and higher material costs, according to W. O. Lawson, plant engineer, plastics division, E. I. du Pont de Nemours, Arlington, N. J. This means that every job must be planned, that tools and materials must be on hand, and that care must be given to scheduling. A procedure for securing these results was described by Mr. Lawson, who stated that the efficiency of a maintenance system may be measured by the number of interruptions or emergency jobs. In the Arlington plant, emergency jobs are studied and the causes classified with the purpose of reducing the number necessary. In concluding, the speaker reiterated the assertion that eliminating waste motion pays in maintenance just as it does in manufacturing.

"High-peak demands on the maintenance department arise from many causes," said A. E. Windle, plant engineer, Colgate-Palmolive-Peet Co., Jersey City, N. J., the second speaker. Seasonal activity, deferred maintenance, lack of planning, fires, floods, and sabotage, are frequently responsible for piling-up maintenance work. Planning, analysis, and constant checking of conditions will help to reduce the frequency of peak demands. If a peak arises in spite of everything, it can be met, according to Mr. Windle, by overtime, which if prolonged too long, is apt to be dangerous, due to accidents from fatigue; by shifting the schedule of working hours; or by using employees from other departments. In large cities, it may be

possible to call in a maintenance contractor, and if the peak is likely to be of long duration, it may pay to hire temporary mechanics.

J. I. Thompson, plant engineer, Bristol-Myers Co., Hillside, N. J., pointed out the danger of too much system in a maintenance department, and emphasized the need for encouraging initiative and ingenuity, for which there is more room in maintenance work than in production. He described in broad outline the organization of a maintenance department in which due attention was paid to flexibility, and discussed the related problems of training mechanics for broader usefulness.

An active discussion period followed, and many questions were asked of the speakers.

NATIONAL LABOR RELATIONS ACT EXPLAINED

J. Warren Madden, chairman of the National Labor Relations Board, had been scheduled to discuss at one of the sessions the administration of the National Labor Relations Act by the board. Since important duties in Washington, prevented his attending, the meeting was addressed by the able regional director of the board in the New York area, Elinore M. Herrick.

Before an audience of 400 engineers, personnel directors, business and industrial executives, Mrs. Herrick answered the charges of bias, labor favoritism, inconsistency, and personal judgment made against the board. She declared that the courts, including the nation's highest tribunal, had "almost uniformly sustained" the National Labor Relations Board. After defining the National Labor Relations Act (Wagner Act), she went on to say:

> There is a vital need today to look at both sides of the picture, a vital need for the exercise of sound judgment in assaying the problem of labor relations in the interest of the entire community. In the exercise of judgment, the equities for employers no less than for labor must be weighed . . . . the principles underlying the Wagner Act are sound and, in time, will provide the firm foundation for a new and more wholesome relationship between employers and employees.
>
> First, it is claimed that the board is biased. . . . The facts are, however, as contained in a recent report on the work in the Second Region which comprises the most concentrated industrial area in New York, New Jersey, and Connecticut, that 55.1 per cent of the cases filed by the A. F. of L. have been amicably adjusted before any formal complaint was issued or public hearing held, and 61.5 per cent of those filed by the C. I. O. have been thus amicably adjusted. A second aspect of this charge of bias is that the board decides all cases in favor of labor . . . . since the board does not initiate any investigations, a charge or petition for certification of a collective bargaining agency must first be filed by union or individual. On this presentation of evidence embodied in a charge and backed by supporting affidavits, the regional office undertakes an investigation of the merits of the case. It is in the course of these investigations that here in the New York area almost 60 per cent out of approximately 1350 cases have been settled in the course of the investigation. 26.3 per cent of the total cases were dismissed during this period, chiefly because our investigation disclosed that the charges were unfounded . . . . . in other words, these cases were settled in favor of employers.
>
> Secondly, the board is criticized as not deciding cases on the basis of the testimony but on the basis of its own personal views. . . . . I wish to point out that if the board errs, there are still the courts which must pass upon the entire procedure of the board in the application of the act.
>
> Another criticism is that the board has usurped and exercised powers not granted to it by the Congress . . . . . The Act is designed "to encourage the practice and procedure of collective bargaining" as a means of improving the condition of the workers of the country. . . . . The board in accepting this direction by Congress has established the following standards which have been based on careful, conscientious investigation and consideration of all the equities. . . . . These standards of criteria are:
>
> (1) The history of collective bargaining in the plant or industry.
> (2) What are the interests of the various employees affected?
> (3) What are the various working relationships between groups of employees in the plant or industry?
> (4) What are the wishes of the employees as evidenced by the manner and form in which they have organized?
> (5) What arrangement would best effectuate the purposes of the Act, namely, to encourage collective bargaining?
>
> Another source of criticism arises from what has been stated as the board's interference with an employer's right to discharge . . . . . The Act permits the board to step in only where discharge results from an employee's union or organizational activity. . . . . The board does not question an employer's right to fire for any reason whatsoever except for union activity.
>
> Summing up all these criticisms . . . . . we have the testimonial of the various circuit courts of appeal of the United States, all but one of which have stated that the board is functioning in a manner consistent with the statute and with all fairness and impartiality. It is charged that the board has decided cases on their own predilections, but the courts have decided the cases on facts . . . . . and in the only cases decided by the United States Supreme Court the story is the same.

In the discussion which followed her talk, Mrs. Herrick answered the many questions fired at her by the audience. She reiterated her statement that employers can always turn to the courts for relief in case of an adverse decision by the board. In case of an election ordered by the board, she requires that at least 85 per cent of the eligible employees vote, otherwise further investigation into the merits of the case is instituted.

PROBLEMS IN UNIONIZED PLANTS DISCUSSED

Asking for a closer relationship between management and its foremen, H. B. Bergen, industrial relations councilor with McKinsey, Wellington & Co., opened the session dealing with problems in unionized plants on Wednesday morning, Dec. 8, 1937. Mr. Bergen cited instances where executives have established new policies or changed wage schedules without consulting the foremen and supervisory executives who are the key men in the relationship between management and labor. Then one should not forget that the attitude of unions seems to depend to a large extent on the personnel policies and methods of management. It is the duty of an industrial relations manager to coordinate these problems. He claimed that the approach of engineers to these problems has been too mechanical, and that more thought should be placed on phases of collective cooperation and better methods of time and motion study.

"Collective bargaining should not be collective arguing," stated George W. Taylor, industrial research associate of the University of Pennsylvania and impartial arbitrator for the Philadelphia men's clothing industry and for the national women's hosiery industry. He then discussed methods used by union leaders in organizing, and in holding membership and gains. On the other side of the picture, he described the means used by employers to keep unions out of their industry. Therefore, in his dealings with these two opposing factions, he has given up hope in trying to establish "genuine" collective bargaining when an "open-shop" agreement is used. In one case mentioned, he told of the management's finally asking the union to agree to a "closed shop."

In collective bargaining, one must use a factual approach. Responsible unions and fair employers are always willing to do their part in settling grievances of workers amicably. The unions are confronted with the problem of providing jobs for their members, especially true in highly mechanized industries, where jobs are getting scarcer with every introduction of a new machine. Therefore the unions are justified when they insist that the "property right of a worker in his job" must be recognized by industry.

"Should wages in an industry be established by a union on an

intraplant or nation-wide basis? was the next point discussed by Mr. Taylor. He claimed that, in most cases, the matter can be threshed out during the negotiations. It is the "Rip Van Winkles" of American industry who usually feel the impact of a nation-wide wage scale. These industries must realize that costs can be reduced, not only by wage cuts, but by reducing industrial waste and inefficiency through scientific management. In his study of such cases, Mr. Taylor has found a variation of as much as 75 per cent in piece rates in different plants. In some of these industries, unions are trying to correct the inequalities by providing the management with industrial engineers to assist them in working out these problems for the good of all. Management must face the fact that an industry wage policy can be reconciled with sound management incentives, and that arbitration is a very good substitute for strikes.

The discussion following the presentation of the two talks was very interesting to the more than 300 persons in the audience. Among those who took part in the discussion were Lillian Gilbreth, H. Diemer, Alvan L. Davis, Allan H. Mogensen, and A. L. Williston.

PRACTICAL SOLUTIONS TO LABOR PROBLEMS

Intense interest and active participation featured the panel discussion on "Practical Solutions to Labor Problems," held the afternoon of Dec. 8, 1937, in the Engineering Societies Building. Members of the panel were H. A. Cozzens, superintendent, American Hard Rubber Co.; F. M. Gibson, plant engineer, American Sugar Refining Co.; J. L. Talbot, factory manager, S. S. White Dental Mfg. Co.; J. W. Towsen, personnel director, W. Virginia Pulp & Paper Co.; and F. J. Van Poppelen, industrial engineer, Remington Arms Co. G. A. Johnson, personnel director, Westinghouse Electric & Mfg. Co., served as chairman.

The problem of justifying incentive plans to the employees in unionized plants was the first subject introduced. In the discussion that followed, it was pointed out that rate setting for such plans is not yet a science, that unions object to many of the methods of rate setting, including demonstrations and the use of "speed artists," and that there is a great need for taking the mystery out of time studies and for the frank and open discussion of time studies with the foremen and the men. It was also pointed out that the relation between rates is as likely to cause trouble as faulty rate setting. Changing rates due to new conditions or to improvements in technology may be troublesome, and should be thoroughly threshed-out with union representatives, who must be sold on the necessity of the change.

What management can do to maintain efficiency if incentive plans are dropped, either on union request or because of changes in management policy, was the second point raised for discussion by the panel. General opinion seemed to be that time and motion-study work should be continued, and that new data plus old standards and records should be used for scheduling, control, cost accounting, etc. There seemed little assurance in anyone's mind that performance on day work would equal that on piece work. Something can be done to improve conditions, however, by educating employees and supervisors in proper work methods and trying to sell the idea of more production.

Unionization has brought a need for a definite procedure for handling grievances, but the panel discussion showed little agreement as to the relative merits of the steward system and the committee system. With the committee plan, it was pointed out, there are always witnesses to decisions; committees are apt to be more conservative than individuals, and frequently enjoy more prestige among the men than an individual. On the other hand, it is sometimes easier to sell an idea to one person than to several, and the steward system is likely to be more efficient and cheaper. Talk of grievances brought the statement that foremen should be trained to anticipate conditions out of which grievances will arise, thus lessening the number that have to be handled. This might be part of a move to give back to the foreman much of the responsibility that has been taken from him in the last few years. This in turn means clear managerial policies, policies which should be fully known to the foremen.

Talk of putting more responsibility on foremen naturally brought the discussion around to plans and methods for training foremen. The general consensus seemed to be that the conference method could not be dispensed with, in spite of the cynical attitude often taken toward it. Good conference leaders are needed, and company policies and reasons should be available for discussion. Regular meetings of foremen to consider day-to-day problems are also extremely helpful when carefully used.

In view of present business conditions, the matter of handling reductions in working force attracted real interest. In general, unions seem to prefer seniority, but in some cases have considered efficiency, fitness, and need, falling back on seniority when other things are equal. Even where seniority is the policy adopted, many problems arise in administering it. A sound procedure in many cases is to put the matter up to the union or to the employees, since it affects them most.

In the general discussion that followed the panel discussion, additional light was shed on incentive problems and on the question of maintaining efficiency in plants on a day-work basis. Several plans for handling grievances were described, and the importance of written and signed complaints was emphasized. It was also pointed out that much misunderstanding can be eliminated by committing managerial policies to writing and making them available to employees. A show of hands indicated that most of the companies represented at the meeting followed this plan. In response to other questions, a show of hands indicated that most companies granted vacations with pay to wage earners and that most do not lay off foremen or supervisors but hold them in the same position or demote them to non-supervisory jobs for the duration of the slack period.

A question on sharing the savings from time-and-motion-study improvements in working methods brought an avalanche of ideas. These ranged from the belief that any saving should be shared with the workers, to the more general opinion that the best bet was to pass along savings indirectly by lowering prices. This was believed to be economically sound, and it seemed to eliminate the many practical problems involved in apportioning savings between workers and management.

NATIONAL APPRENTICE TRAINING DISCUSSED

A need for a definite training program was discussed by W. F. Patterson, executive secretary of the Federal Committee on Apprentice Training, Washington, D. C., before a group of engineers, personnel directors, vocational advisors, and students. In his paper, which was entitled "The National Apprenticeship: A Working Truce in One Sector of Industrial Relations," Mr. Patterson brought out very clearly the need for a federal coordinating apprentice service. The complete paper will be found in this issue of MECHANICAL ENGINEERING on pages 45 and 46. Taking part in the interesting discussion, which followed Mr. Patterson's paper, were C. J. Freund, C. R. Dooley, J. A. McCarthy, Warner Seely, M. B. Richardson, and Elmer H. Neff. This paper concluded the sessions which were directly sponsored by the Management Division of the Society and its various subcommittees.

LETTERS AND COMMENT

Brief Articles of Current Interest, Discussion of Papers in Previous Issues

Mechanical Engineers in the Electrical Industry

To the Editor:

The paper[1] by Messrs. Stevenson and Parker brings to us, as engineers, fuller realization of the extended field of present-day technology. The profession of engineering offers continuous challenge to all of us, the elders equally with the beginners. Problems must be solved; eager and courageous men are needed to evolve fundamental ideas, put them into execution, and apply the result intelligently for the benefit of mankind.

Well within the memory of many who are still youthful in spirit if not in years, the electron theory was something for physicists and scientists to play with. Today, radio touches the daily life of each individual, not only in communications but also in many useful and practical industrial applications. Similarly, the average citizen, whether he is aware of it or not, is from moment to moment in his daily life served and aided by useful and valuable applications of technology.

With these facts before us, it is proper that the "elders" turn now and again to thoughtful consideration of appropriate training of the young engineer. To gain appreciation of the opportunities offered to the young mechanical engineer in the electrical manufacturing industry, one need only visit the extensive works of such an organization. The engineering professors' summer conference conducted by the General Electric Company, July 6 to Aug. 7, 1937, provided this privilege for a group of twenty-two professors. Extensive studies and factory inspections were made of the works at Schenectady, Pittsfield, and Bridgeport. Each member of the group gained intimate insight into the extensive scope of applications of technology and science in the electrical industry. Each professor found occasion to be proud and pleased to observe, first-hand, accomplishments of engineering graduates of his own and sister institutions.

[1] "The Young Mechanical Engineer in the Electrical Industry," by A. R. Stevenson, Jr., and E. E. Parker, Mechanical Engineering, October, 1937, pp. 725–731.

The authors are again reminding us that engineering colleges should constantly emphasize understanding, knowledge, and appreciation of the fundamentals of science and technology. Because they are associated with an industrial organization which this year added more than 600 young college graduates to its staff, the authors are qualified to speak with authority.

Along with consciousness of the importance of emphasis on fundamental concepts, the colleges are obliged to recognize three additional strong considerations in training their students. The first is that a large number, even a majority, of graduates are placed with the smaller industrial organizations in which the immediate demands made of the young engineer are specific. The second is that the applicant for admission to college often has a definite personal objective in view. The third consideration involves the practical ability of the young engineer to cooperate with his associates.

The first calls for realistic approach to a wide variety of technical activities. The student needs to have a competent introduction to the principal sectors of engineering practice and technics such as, for example, generation, distribution, and utilization of power; design and construction of machines; shop operations and production methods and processes; the process industries; transportation; and heating, ventilation, and air conditioning, to mention a few. When he is graduated, the student should be in a position to visualize his personal relationship to the broad field of engineering so that he can embrace such definite opportunities as may be presented in either the large or the small organization.

The second consideration is of great personal importance to the student. At present, many young men of promise are attracted to an engineering career because of the current popular appeal of radio, the Diesel engine, the airplane, or air conditioning. Questionable as these motives frequently seem to the experienced engineer, to the youth they offer an objective, something that appeals to his interest. While his convictions may be colored by his romantic, or so it seems to others, picture of himself as the airplane designer of the future, yet, nevertheless, the motivation is substantial and worthy of respect. The intelligent youngster understands that adequate preparation for any one of these fields demands thorough training in fundamentals. He is willing and able to pay the price in determination, effort, and hard work. The faculty, therefore, must maintain proper relations with such students, encouraging their personal interests and, at the same time, offering thorough grounding in fundamentals, developing the students' innate ability for self-directed expression, and enhancing their determinations and objectives. The surprising and pleasing result of this seemingly haphazard procedure is that so many young men actually enter their chosen field and rapidly develop into useful and valuable engineers.

The third reason for offering an introduction to technics as well as basic training in fundamentals is that the young engineer must be able to understand and appreciate the work of his associates. He must cooperate with them and speak their language.

The engineering college has a difficult function to perform. It must satisfy many and, sometimes, divergent demands. It must be all things to all men. Our thanks are due to the authors for their stimulating, encouraging, and helpful paper. They have challenged the colleges to broaden the outlook and to enlarge horizons.

R. B. Dale.[2]

[2] Supervisor of Industrial Mechanical Engineering, School of Science and Technology, Pratt Institute, Brooklyn, N. Y. Mem. A.S.M.E.

To the Editor:

The authors are to be congratulated on this clear exposition of some technical activities in the electrical industry for which the young mechanical engineer is well adapted; for which, in fact, others must obtain an equivalent background to compete with those who are well-grounded in mechanical engineering. When I turned to this paper and found it

entitled, "The Young Mechanical Engineer in the Electrical Industry," my thoughts spread out at once to the many and widely differentiated fields of activity in the electrical industry for which a mechanical-engineering education is of great value. As I read further and further and found the paper limited to these technical phases, I began to suspect that I had fallen into the old trap of considering every mechanical-engineering graduate to be a young mechanical engineer.

I believe that a technical education, for those who are drawn toward it and can do well in it, affords a splendid background for almost any occupation. In my own company, we have many types of work, to be considered for which college men must have some form of technical education. We have other work for which a nontechnical or a technical man can be considered. Thus, when a technically trained man is ready for assignment, he can be considered for that type of the company's work which promises the greatest exercise for his major interests and abilities. From my point of view, then, a mechanical-engineering education is excellent for almost any industrial activity, particularly since electrical-engineering and civil-engineering subjects have been introduced as important factors in mechanical-engineering curricula.

Getting back to the technical activities of young mechanical engineers, this paper should go far in enlightening any who still regard the electrical industry as exclusively electrical in all its activities. Even so broad and enlightened a mechanical-engineering educator as the late Herman Diederichs of Cornell, after a trip through parts of the Western Electric works at Hawthorne, Ill., some years ago, expressed himself to me, in substance, as follows: Previous to that inspection trip, I had felt that telephone work made but little appeal to the aspirations of graduates whose main interests were connected with the technical phases of mechanical engineering. I was amazed to find that the only process I saw which directly involved electrical work consisted of testing the continuity and other electric characteristics of cable conductors during manufacture. Mechanical problems and processes were found at every turn.

I am confident that in this paper the authors have made the point which they set out to establish.

HOWARD L. DAVIS.[3]

[3] Director of Technical Employment and Training, New York Telephone Company, New York, N. Y.

TO THE EDITOR:

I wish to extend sincere thanks to Messrs. Stevenson and Parker for making so complete and interesting a list of the jobs that the mechanical engineer does in the electrical manufacturing plant. An impression has been, and perhaps still is, prevalent that the work of the mechanical engineer is subordinated in such a plant but after reading the paper, the opposite thought of "What is there left for the electrical engineer to do?" may exist in one's mind. When one considers that the things which can go wrong, even with electrical machines, are perhaps from 80 to 85 per cent mechanical in their nature, it becomes obvious that a broad base of mechanical-engineering skill is necessary for success in all lines of engineering and particularly in electrical engineering.

Not only are mechanical-engineering graduates necessary and welcome in our industry in large numbers, but also we are making efforts through special educational and training courses to give to the mechanical engineer as rapidly as possible the background for the problems peculiar to a combination of electricity and mechanical principles. As a well-known instance of where mechanical-engineering skill unites with a peculiarly electrical structure, consider the commutator on large direct-current machines. Here we have a difficult combination of a large assembly of small metal parts interspersed with sheets of mica insulation which, as a whole, must be, in turn, insulated from the mechanical structure that supports it. Such an assembly may be arch bound by pulling in the wedge-shaped bars, it may be drum bound by pulling or banding them down on a cylinder or it may be V-bound by bushings that engage the ends of the bars axially. Plainly, nothing but a mechanical-engineering problem, and apparently a simple one, but I can assure you one that has cost more in time and brains and money than most manufacturers care to think about. It is one of a thousand strictly mechanical problems for which a better solution may yet be found than those now used in the art.

A point that kept recurring to me as I read the paper was the matter of training draftsmen who may, and later do in many cases, develop into designing mechanical engineers. There never seem to be enough of such men with ingenuity in mechanisms and inventive ability to develop new products. Part of this seems to be that we have been careless about giving credit where credit was due on finished designs so that recognition was hard won and part of the difficulty is due to the fact that no one tries to sell the technical graduate in mechanical engineering the idea that an adequate career can be laid whose gateway is the drawing room. I am fully aware that the engineering profession, as a whole, has been prejudiced against drafting practice as an asset to an engineer, but I am as fully cognizant that a number of strong engineers of my acquaintance had that background. So while we are telling the boys of possible "toe holds" from which to make good, let's at least suggest this one. This idea, while somewhat afield from the subject of the paper, leads to the related one of the place of instruction in drawing in technical schools. For two years, I have been doing some work for the Engineers' Council for Professional Development as a representative of the American Institute of Electrical Engineers. In that work, practically all the technical schools of the country have been visited and their engineering curricula appraised as to being up to the minimum standard for a good four-year engineering course. This was to unify the requirements of the State Boards of Examiners in various states who are licensing professional engineers. The Engineers' Council for Professional Development is the agent of the national engineering societies, including the A.S.M.E., the Society for the Promotion of Engineering Education, and the National Council of State Boards of Engineering Examiners. In the schools that I visited which were in New York and Pennsylvania I noticed a trend toward reducing the instruction given in drawing to make way for new subjects which a rapidly expanding art almost forces on the curriculum makers. This may be as it should be but it should not proceed to the point reached by shop practice in schools which relies to a large extent on the boys getting that experience in summer work.

For the benefit of students and young engineers whom I take it we are trying to help, I would call attention to the proved value of student courses such as those described by Messrs. Stevenson and Parker. If for no other reason, these training periods of a year or more give the student a chance to orient himself, to look at all kinds of jobs, to compare the engineers who work on them with himself, and to reach his own decision as to where his skill lies and where he can most effectively apply it.

The paper also refers to opportunities for mechanical engineers on supervisory or planning jobs in the shop. The new

graduate is apt to think of the shop as being an exclusively practical place where his hard-earned theory would be out of place. This is not the case and nowhere is there greater need for technically trained brains than in manufacturing methods and processes. I believe many of us have had the surprising experience of meeting men with Ph.D.'s in the shops of European factories and finding that, besides being keen engineers, they were also good executives. This field will bear intensive cultivation by our new graduates in mechanical engineering. We are turning out some men we call management engineers and industrial engineers, but plenty of room remains for applying straight mechanical-engineering principles to shop work.

Our authors have touched briefly on mechanical research, but that is a wide field in itself. That group of mechanical engineers who followed along with Dr. Timoshenko and many of whom have gone back to teaching at Michigan and Stanford and Harvard and Columbia have demonstrated that the knowledge of elasticity and vibration and creep of metals can be as exact and as rigorous as that concerning electrical phenomena. In fact, it looks to me at present as though one of the outstanding opportunities both in teaching and in industry offers itself to mechanical engineers who have specialized in theoretical mechanics.

Since I have mentioned it, may I call the attention of all young engineers to the work of the Engineers' Council for Professional Development which has one large committee engaged entirely on advising the engineering graduate how to build himself up broadly by graduate reading and study, so that he may contribute his part to securing greater recognition for the whole engineering profession.

These comments may not apply directly to the paper but I believe they are of interest to all of us who are trying to correlate the training in school and the training in manufacturing practice of young mechanical engineers.

A. M. DUDLEY.[4]

[4] Marine Electrical Engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

A.S.M.E. BOILER CODE

Interpretations

THE Boiler Code Committee meets monthly for the purpose of considering communications relative to the Boiler Code. Anyone desiring information on the application of the code is requested to communicate with the Secretary of the Committee, 29 West 39th St., New York.

The procedure of the Committee in handling the cases is as follows: All inquiries must be in written form before they are accepted for consideration. Copies are sent by the Secretary of the Committee to all of the members of the Committee. The interpretation, in the form of a reply, is then prepared by the Committee and passed upon at a regular meeting of the Committee. This interpretation is later submitted to the Council of The American Society of Mechanical Engineers for approval, after which it is issued to the inquirer and published in MECHANICAL ENGINEERING.

Following is a record of an interpretation of this Committee formulated at a meeting of the Committee on October 28, 1937, and approved by the Council.

CASE No. 849

(Interpretation of Par. A-20)

Inquiry: May fusible plugs which comply with the requirements of the General Rules and Regulations of the Bureau of Marine Inspection and Navigation be used in pl ce of those specified in the Boiler Code?

Reply: It is the opinion of the Committee that fusible plugs which comply with the requirements of the General Rules and Regulations of the Bureau of Marine Inspection and Navigation may have the letters "A.S.M.E.," required by Par. A-20, stamped by the manufacturer on the casing (instead of on the fusible metal) and the plug will then be acceptable.

CASE No. 850

(Interpretation of Pars. P-105c and U-74)

Inquiry: On the basis of test data submitted, will it be permissible to modify the requirements of Pars. P-105*c* and U-74 to permit drilling tube holes $^1/_8$ in. from the edge of a weld made in accordance with the requirements of Pars. P-101 to P-109, inclusive, or U-68?

Reply: On the basis of the data submitted, it is the opinion of the Boiler Code Committee that from a safety standpoint, it is permissible to modify Pars. P-105*c* and U-74 to allow unreinforced holes to be machine-cut through welds made in accordance with Pars. P-101 to P-109, or U-68; but as it may be difficult properly to expand or roll tubes into holes where the metal around the entire circumference may be of varying hardness, tube holes, for rolled or expanded tubes, shall not be placed closer to a weld than $^1/_4$ in. from the edge of the fused metal.

CASE No. 851

(In the hands of the Committee)

CASE No. 852

(Interpretation of Par. P-321)

Inquiry: Is it permissible, under Par. P-321 of the code, which calls for crosses to facilitate cleaning at each right angle turn in the water connections of water column piping, to use instead a flanged back outlet elbow with a bolted cover on the outlet?

Reply: It is the opinion of the Committee that any fitting with a back outlet that will permit cleaning in both directions will be acceptable as the equivalent of a cross for the purpose intended.

Proposed Revision of A.S.M.E. Code for Unfired Pressure Vessels

AS STATED in an article published in the October, 1936, issue of MECHANICAL ENGINEERING under the above heading, the A.S.M.E. Boiler Code Committee contemplates a complete revision of Section VIII of the A.S.M.E. Boiler Construction Code which covers the construction of unfired pressure vessels. Further study by a special committee indicates the proposals previously published should be modified in some respects. The plan which is now under consideration by the special committee appointed for the purpose follows. The committee is anxious to obtain as many criticisms and suggestions as possible. Communications should be sent to the Secretary, Boiler Code Committee, 29 West 39th St., New York, N. Y.

(Continued on following page)

PROPOSED REVISION PLAN

(1) Make the rules in the Code bear only on the construction and testing of vessels, with no service inspection requirements.

(2) Provide two formulas for determining the maximum allowable working pressure, one with an additive quantity for a corrosion allowance and the other with no additive quantity. The factors of safety would be given for various shell thicknesses for the formula with no corrosion allowance, so that the inspectors could check up the working pressure in the way in which they are accustomed.

(3) Embody statements along the lines of those given in Par. L-20 of the A.S.M.E. Locomotive Boiler Code, to read as follows:

"The factor of safety used in design construction of new pressure vessels shall be not less than that given in Par. 5.

The factor of safety used in determining the maximum allowable working pressure calculated on the conditions actually obtained in service shall be not less than 4."

(4) Retain the folllowing provision from the A.S.M.E. Code for Unfired Pressure Vessels:

"U-11 All pressure vessels, which are to contain substances having a corrosive action upon the metal of which the vessel is constructed or those subjected to erosion or mechanical abrasion, shall be designed for the pressure they are to carry, and the thickness of all parts subject to corrosion, erosion, or abrasion should be increased by a uniform amount to safeguard against early rejection."

(Continued on following page)

Revisions and Addenda to Boiler Construction Code

IT IS THE policy of the Boiler Code Committee to receive and consider as promptly as possible any desired revision of the Rules and its Codes. Any suggestions for revisions or modifications that are approved by the Committee will be recommended for addenda to the Code, to be included later in the proper place in the Code.

The following proposed revision has been approved for publication as proposed addenda to the Code. It is published below and is submitted for criticism and approval from any one interested therein. It is to be noted that a proposed revision of the Code should not be considered final until formally adopted by the Council of the Society and issued as pink-colored addenda sheets. Communications should be addressed to the Secretary of the Boiler Code Committee, 29 West 39th St., New York, N. Y., in order that they may be presented to the Committee for consideration.

TABLE P-2A

The following table is proposed as a revision of the one published in the January, 1937, issue of MECHANICAL ENGINEERING to apply to seamless steel tubes for pressures 1000 lb per sq in. and over, as there is urgent need for a reduction in tube thickness of high-pressure boilers. Present Table P-2 of the Power Boiler Code will continue to apply to seamless steel tubes for pressures less than 1000 lb per sq in. and for welded tubes for all pressures, this part of the table being still under consideration for revision.

TABLE P-2A MAXIMUM ALLOWABLE WORKING PRESSURES FOR SEAMLESS STEEL TUBES FOR WATER-TUBE BOILERS, CONFORMING TO THE REQUIREMENTS OF SPECIFICATIONS S-17, GRADES A AND B, AND S-40 FOR PRESSURES 1000 LB PER SQ IN. AND OVER*

(Based on Maximum Allowable Stress of 9000 Lb Per Sq In.)

MINIMUM THICKNESS OF TUBE WALLS IN BWG AND INCHES

O.D. INCHES	15 .072	14 .083	13 .095	12 .109	11 .120	10 .134	9 .148	8 .165	7 .180	6 .203	.220	.240	.260	.280	.300	.320	.340	.360	.380	.400	.420	.440	.460	.480	.500
1/2	1030	1480	1980	2560																					
3/4			1220	1610	1910	2300																			
1				1130	1360	1650	1940	2290																	
1-1/8					1180	1430	1690	2000																	
1-1/4					1030	1260	1490	1770	2020																
1-1/2						1000	1190	1430	1640	1950	2190														
1-3/4								1180	1360	1630	1830	2070													
2								1000	1150	1390	1570	1770	1980	2190											
2-1/4										1200	1360	1540	1730	1910	2100										
2-1/2										1050	1190	1360	1530	1690	1860	2020									
2-3/4											1060	1210	1360	1510	1660	1810	1960	2110							
3												1080	1220	1360	1500	1640	1770	1910	2050						
3-1/4													1110	1230	1360	1490	1620	1740	1870	2000	2120				
3-1/2													1010	1120	1240	1360	1480	1600	1720	1830	1950	2070			
3-3/4														1030	1140	1250	1360	1470	1580	1690	1800	1910	2020		
4															1050	1150	1260	1360	1460	1570	1670	1770	1880	1980	2090
4-1/2																	1080	1180	1270	1360	1450	1540	1640	1730	1820
5																		1030	1110	1190	1280	1360	1440	1530	1610

$$P/S = 2.3\,(t - 0.04 \text{ in.})/D - 0.03333$$

where P = maximum allowable working pressure, lb per sq in.; S = maximum allowable stress, lb per sq in.; D = outside diameter, in.; t = thickness of tube wall, in.

For $S = 9000$

$$P = 20{,}700\,(t - 0.04 \text{ in.})/D - 300$$

* These values have been rounded out to the next higher unit of ten in accordance with Note (1)

NOTES

(1) For pressures higher than given in the table the allowable working pressures shall be the next higher units of ten above the values given by the formula.

(2) For Grade C tubes, Specification S-17, the value of "S" in the formula may be taken at not over 12,000 lb per sq in., as compared with 9000 lb for Grades A and B tubes, provided the tubes are annealed or normalized and drawn, and the tensile strength of the tubes is not less than 60,000 lb per sq in.

$$P = 27{,}600\,(t - 0.04)/D - 400$$

(3) The following formula may be used for determining the maximum allowable pressures for seamless steel tubes for forced-circulation water-tube boilers when the tubes are not expanded into tube seats:

$$P/S = 2.3\,t/D - 0.03333$$

where P = maximum allowable working pressure, lb per sq in.,
S = maximum allowable stress, lb per sq in.,
D = outside diameter, in.,
t = thickness of tube wall, in.

For $S = 9000$
$P = 20{,}700\,t/D - 300$

For $S = 12{,}000$
$P = 27{,}600\,t/D - 400$

(5) Use the following actors of safety for construction:

Plate Thickness, in.	Factor of Safety
$2^1/_{16}$	$4^1/_8$
$1^1/_{16}$	$4^1/_4$
$^9/_{16}$	$4^1/_2$
$^5/_{16}$ and less	5

These factors correspond to a factor of 4 with a corrosion allowance of $^1/_{16}$ in. for all plate over $^5/_{16}$ in. in thickness.

(6) Consider whether the rules covering air tanks for garages and similar services shall be in substantial accord with those in force for a number of years in the State of California, which have given excellent results. This will be borne in mind when the question of services for which vessels are to be used is decided upon.

(7) Stamp vessels which are X-rayed "XR," and those which are stress relieved "SR." Agree on the construction requirements before taking up the conditions under which the "XR" and "SR" vessels shall be used.

(8) Use the same joint efficiencies as in the API-ASME Code for Unfired Pressure Vessels.

(9) Publish the Rules for Inspection of the API-ASME Code, these to be recommended rules and not to be mandatory.

(10) Do not include A.S.T.M. Specifications A 7, A 10 and A 113 in the code. Include the following provisions:

"Unidentified material from warehouses may be used provided the chemical and physical tests are made of each plate of the material and that such tests meet the requirements of one of the specifications and the design is in accordance with that specification. For plates $^3/_8$ in. or less, only the carbon and the physical tests need be checked."

(11) Stress relieve the test coupons for plate to be used for vessels which will be stress relieved as called for in Par. W-201 of the API-ASME Code.

(12) Include a table to give the unit-working stresses for steels at high temperatures. Active work is being done by the Subcommittee of the Boiler Code Committee on Ferrous Materials to revise Tables P-8 and U-3 which give the unit working stresses for different temperatures.

(13) Omit section (*a*) of Par. W-313 of the API-ASME Code bearing on the location of openings in heads, (*b*) to be retained as an advisory statement.

(14) Revise the rules for stress relief of fusion-welded vessels in accordance with the latest revisions of the A.S.M.E. and API-ASME Codes.

(15) Consider the allowance of a 2-in. deduction of diameter in the rules for reinforcements as in the A.S.M.E. Code. The views of the Special Committee of the Boiler Code Committee on Rules for Openings is to be secured.

(16) Require 30 per cent elongation in the bend tests for stress relieved welds, and 20 per cent for unstress relieved welds.

(17) Include the A.S.M.E. Code rules for brazed vessels.

(18) Include rules for cast iron pressure vessels. The American Petroleum Institute has been asked to give consideration to the rules now in the A.S.M.E. Code and to make recommendations based on experience in the petroleum industry.

(19) Include the A.S.M.E. Code rules for enameled vessels.

(20) Include rules for vessels under external pressure. The A.S.M.E. Code rules are to be revised, if necessary, on the basis of work that is being done by a special committee of the American Petroleum Institute.

(21) Include the A.S.M.E. Code rules for containers for gases and liquids at temperatures from minus 10 to minus 150 F.

(22) Include the A.S.M.E. Code rules for limitations of sizes of unreinforced openings in cylindrical shells unless some more complete rules are suggested by the Special Committee on Rules for Openings.

(23) Include A.S.M.E. Code rules covering qualification of welding processes and the testing of welding operators. These rules are based on those of the American Welding Society.

(24) Include rules for bolted flanged connections; these are to be revised on the basis of recommendations from the special committee that is working on the subject.

(25) Include rules for the standard practice for making hydrostatic tests on a pressure part to determine the maximum allowable working pressure, the rules of the A.S.M.E. Code to be implified for the purpose.

REVIEWS OF BOOKS

And Notes on Books Received in the Engineering Societies Library

Bearing Metals and Alloys

BEARING METALS AND ALLOYS. By Henry Norman Bassett. Longmans, Green & Company, New York, N. Y., and Edward Arnold & Co., London. Cloth, $5^1/_2 \times 8^1/_2$ in., 428 pp., illustrated. $8.50.

REVIEWED BY CHRISTOPHER H. BIERBAUM[1]

REVIEWING Mr. Bassett's "Bearing Metals and Alloys," a book that represents years of conscientious study in the field of the reviewer's own endeavor, is certainly a pleasure. The volume under consideration is replete with references and citations, broadly covering the subject. It is free from all ipse dixit and unwarranted dogmatic conclusions. Its limitations, if any, seem to lie entirely in the state of the art rather than in the book itself.

The author refers to the investigations which show the beneficial effects of oxidation upon the lubricating properties of oil, and also the D.O.C. (direct oil corrosion) tests, their corrosive effect upon metals; this as yet is balancing a beneficial effect against a destructive one. The most ideal bearing can be destroyed under service conditions by the corroding action of the oxidized oil.[2]

The reviewer distinctly remembers a personal interview with Professor Benjamin of the Case School of Applied Science in which he stated that all coefficient-of-friction tests for bearing materials were a farce, that after the bearing had been properly "run-in," it was simply testing the lubricant. This conclusion seems fully anticipated by Thurston in "A Treatise on Friction and Lost Work in Machinery and Millwork," when he says, "Gun bronze, babbitt, and other soft white alloys... have substantially the same friction. In other words, the friction was determined by the nature of the unguent and not by that of rubbing surfaces, when the latter are in good order."[3] The foregoing conclusions by eminent authorities are distinctly at variance with the many coefficient-of-friction tests for the different metals as given by the author throughout the book. This question however, will never be settled satisfactorily and completely until the subject of adsorbed lubrication is more fully understood, since it has been clearly shown that different metals are differently affected by both adsorption and corrosion.

In operating and testing bearings, two elements should always be considered, the bearing and its journal. There is

[1] Vice-President and Consulting Engineer, Lumen Bearing Company, Buffalo, N. Y. Mem. A.S.M.E.

[2] "Corrosion of Bearing Surfaces," by C. H. Bierbaum, MECHANICAL ENGINEERING, April, 1935, p. 240.

[3] "A Treatise on Friction and Lost Work in Machinery and Millwork," by R. H. Thurston; John Wiley & Sons, New York, N. Y., 1903, p. 152.

an extreme scarcity of cases noted in the book, in which the full details of both members are considered. On p. 57, however, there is one of special interest and the reviewer fully appreciates the author's kindness in not having disclosed the perpetrator of such a folly. The case in question is that of an aluminum-bronze bearing in which the beta crystal had been converted into the hard gamma crystal and the bearing then placed in rolling-mill service on a chilled roll neck. Results proved disastrous owing to the fact that both members were extremely heterogeneous and resulted in an interlocking of hard crystal upon the surface of both members, showing conclusively the necessity of dissimilarity of microstructure for the two members.

The subject of hardening steel surfaces for bearing purposes does not seem to have received the consideration that it deserves. This, however, is in keeping with the state of the art and its literature. In every instance, that part of the material hardened by cyaniding, pack hardening, or nitriding nitralloy expands permanently during the process, with the result that, under an even temperature of case and core, the former is always in a state of compression and the surface immediately beneath it is in tension. All case materials have a higher thermal coefficient of expansion than the core, and, under service conditions, the case is always at a higher temperature than the core; the combined effect, therefore, is to cause the case to buckle and crack.[4]

A clear understanding of what we are aiming at is absolutely necessary.

[4] "Surface Hardening for Bearing Purposes," by C. H. Bierbaum, *Machinery*, November, 1935, p. 204.

It seems that all modern bearing lubrication can be divided into three general classes:

(1) Flooded lubrication
(2) Adsorbed lubrication
(3) Boundary lubrication

The first class represents the ideal condition, a flooded lubrication of which we have the classic researches by Tower. It represents that condition where after "running-in," all the work is done upon the oil film.

The second class is the adsorbed or modern extreme-pressure (E.P.) lubrication It is that in which the lubricating oil has been chemically modified so that the individual molecules have a distinct affinity for the metal surfaces, a distinct metallophilic property. In this field the author has given many valuable citations.

The third class is boundary lubrication where the lubricating oil only serves to mitigate an abrading effect. It represents the modern insatiable demand upon bearing performance and is particularly related to the homogeneous-metal theory. No more important comment on this subject can be made than quoting the author: "Against the homogeneous-metal theory is the fact that a copper-tin alloy, which normally shows hard and soft grains and is a good bearing metal, becomes perfectly useless as such when it is annealed to give an entirely homogeneous structure."

The volume under consideration is the most complete and extensive treatise on the subject of bearing metals and alloys, and an earnest investigator in this field can ill afford to be without it.

Books Received in Library

ATM, Archiv für Technisches Messen. Lieferungen 70–74. April–August, 1937. R. Oldenbourg. Munich and Berlin. Paper, 6 × 12 in., illus., diagrams, charts, tables, paper, 1.50 rm. each. The various numbers of this monthly publication contain articles on instruments and methods for technical measurement procedures. Each article is broadly classified according to a special system, so that related articles may easily be grouped together for filing.

(The) ART OF CARBURATION IN THEORY AND PRACTICE, Including Fuel Distribution in Manifolds. By R. W. A. Brewer. The Technical Press, London, 1937. Cloth, 5 × 9 in., 176 pp., illus., diagrams, charts, tables, 21 s. This book is divided into two sections with independent paging and indexes. The first is a technical discussion of the phenomena, problems, and mechanical equipment of carburation. The second section covers the economics of carburetting and manifolding, indicating methods for increasing the efficiency of the processes.

BUSINESS ADMINISTRATION FOR ENGINEERS. By C. F. Harding and D. T. Canfield. McGraw-Hill Book Co., New York and London, 1937. Cloth, 6 × 9 in., 637 pp., diagrams, charts, tables, $5. Intended to assist the young engineer in correlating engineering with business, this book sets forth in the engineer's language, the organization, economic, and managerial problems of the industries and public-utility corporations with which he is likely to be associated. Recent developments are illustrated by numerous tables and figures.

DAVISON'S TEXTILE CATALOGUES AND BUYERS' GUIDE, 1937. Davison Publishing Co., New York, 1937. Cloth, 9 × 12 in., 422 pp., illus., $12. The brief catalogs of manufacturers who serve the textile industry are grouped in 15 sections loosely classified according to use. The "Buyers' Guide" is an alphabetical list covering machinery, raw materials, etc., with an alphabetical arrangement of companies under each heading, a difference in style of type indicating those represented also by catalogs.

DIESEL PLAN BOOK AND ENGINE CATALOG, Vol. 2. Edited by J. W. Anderson, published by R. W. Wadman, printed and distributed by Diesel Engines, Inc., New York, 1937. Cloth, 11 × 14 in., 320 pp., illus., diagrams, charts, tables, $3. A continuation of the 1936 Plan Book, containing supplementary information. In the engine catalog section are descriptions, diagrams, and illustrations of many sizes and types of engines. The Plan Book section includes plant designs, studies of plant-installation problems, reports of individual applications, and several special articles. The general index covers both Vols. 1 and 2.

DIMINISHING RETURNS AND PLANNED ECONOMY. By G. M. Peterson. Ronald Press Co., New York, 1937. Cloth, 6 × 9 in., 254 pp., illus., charts, tables, $3. A textbook of economics which presents a method of analysis useful in teaching the fundamental principles. Its main contribution is a graphic analysis of the law of diminishing returns, showing the relation of this law to numerous other economic concepts often considered independent. Suggested aids for teaching economics are found in appendixes.

EIDGENÖSSISCHE MATERIALPRÜFUNGSANSTALT an der E. T. H. ZÜRICH, LABORATOIRE FÉDÉRAL d'ESSAIS des MATÉRIAUX ANNEXÉ à l'ÉCOLE POLYTECHNIQUE FÉDÉRALE à ZÜRICH, Bericht Nr. 104, 1936. Paper, 8 × 12 in., 15 pp., charts, maps, tables. The first part of report No. 104 deals with the principal burning properties of fossil fuels and the necessity for their proper valuation. The second part treats the nature of different sorts of coal and coal assortments coming from those fields which are of greatest interest to the Swiss market.

ELASTICITY, PLASTICITY AND STRUCTURE OF MATTER. By R. Houwink and W. G. Burgers. University Press, Cambridge; The Macmillan Co., New York, 1937. Cloth, 6 × 9 in., 376 pp., illus., diagrams, charts, tables, $6. A comprehensive study of the elastic and plastic phenomena which accompany the deformation of matter. A great many classes of materials are included, and one object of the book is to compare and unify the results achieved in various fields, thus bringing the physicist, the chemist, and the technologist into closer contact.

ELEMENTARY FOUNDRY TECHNOLOGY, edited by L. A. Hartley. Second edition, reviewed by E. Bramer and P. Dwyer. Penton Publishing Co., Cleveland, Ohio, 1937. Leather, 6 × 9 in., 377 pp., illus., diagrams, charts, tables, $3. The original text of this book was designed to conform to the requirements for instruction material set up for apprentices by the National Founders Association. This second edition has been revised to eliminate obsolete practices and to include recent developments. Material covered includes basic physical, chemical, and thermodynamical phenomena, operations in iron and brass founding, foundry sands, and equipment. There are problems and questions.

5000 YEARS OF GLASS. By F. Rogers and A. Beard. Frederick A. Stokes Co., New York, 1937. Cloth, 6 × 9 in., 303 pp., illus., diagrams, $2.50. A popularly written history of glass from the earliest known manufacture to

modern practice. It covers the development of glass-making processes and glass coloring, with separate chapters on plain and stained window glass, gas and electric-light bulbs, lenses, and mirrors. A final chapter discusses special recent trends and probable future uses of glass.

HARTMETALLWERKZEUGE. By C. Agte and K. Becker. Second edition. Verlag Chemie, Berlin, 1937. Cloth, 6 × 9 in., 239 pp., illus., diagrams, charts, tables, 13.50 rm. Intended as a practical guide for the user of carbide cutting tools. Advice is given on their proper use, methods of tool making, and the selection of tools for various purposes. A list of German patents and a bibliography are included.

HOCHLEISTUNGS-GASERZEUGER für Fahrzeugbetrieb und ortfeste Kleinanlagen. By H. Finkbeiner. J. Springer, Berlin, 1937. Cloth, 6 × 10 in., 99 pp., illus., diagrams, charts, tables, 10.20 rm. The subject under consideration is high-capacity gas producers for vehicle operation and small stationary installations. In addition to information on fuels and gases, reactions, charging methods, development of types for various fuels, and the actual operation of the producer, there are sections on the producer-gas engines and the economics of producer-gas for automobiles.

KOLBENVERDICHTER. By C. Bouché. J. Springer, Berlin, 1937. Paper, 6 × 9 in., 125 pp., illus., diagrams, charts, tables, 9.60 rm. An introductory treatise on the operation and construction of reciprocating air and gas compressors. The thermodynamic principles involved, the reactions in the actual compressor, output and efficiency, multi-stage compression, the typical forms of compressors, methods of regulation, operation, and maintenance are discussed. A chapter on vacuum pumps and one on rotary compressors complete the book.

KRAFTFAHRTECHNISCHE FORSCHUNGSARBEITEN No. 6. V.D.I. Verlag, Berlin, 1937. Paper, 8 × 12 in., 37 pp., illus., diagrams, charts, tables, 6 rm. Number 6 of this series on automotive research contains two articles on shaft couplings; one on those acting obliquely or through an angle, and the other on elastic rotating couplings.

KRAFTFAHRTECHNISCHE FORSCHUNGSARBEITEN No. 7. V.D.I. Verlag, Berlin, 1937. Paper, 8 × 12 in., 25 pp., illus., diagrams, charts, tables, 3.50 rm. Number 7 of this series on technical automotive research contains three articles. The first is on stroboscopic equipment for examining the scavenging process in small high-speed two-cycle cylinders. The second is on the lubrication of cog-wheel gears with respect to direction of rotation in a partial oil bath. The third covers the relation between scavenging and power output in the mixture-scavenged two-cycle engine.

KRAFTFAHRTECHNISCHE FORSCHUNGSARBEITEN No. 8. V.D.I. Verlag, Berlin, 1937. Paper, 8 × 12 in., 26 pp., illus., diagrams, charts, tables, 3.50 rm. Number 8 of this series contains three articles: the first is concerned with the determination of the rate and degree of filling of a gasoline-engine cylinder under varying conditions; the second is on the calculation of the torsional resistance of vehicle frames; the third is a contribution on the development of quartz indicators and their use in measuring pressures in engine cylinders.

MACRAE'S BLUE BOOK AND HENDRICK'S COMMERCIAL REGISTER. Forty-fifth edition, 1937-1938. MacRae's Blue Book Co., Chicago and New York, 1937. Cloth, 8 × 11 in., 3580 pp., illus., $15. This complete, up-to-date, annual volume listing manufacturers and sources of supply of manufactured products in the United States, is divided into five main sections: An alphabetical list of manufacturers, giving addresses and, in some instances, local distributors; an index to the classified section to facilitate its use; the classified material section, an alphabetical arrangement of product leadings with lists of manufacturers under each; a trade-facilities section giving, by states, brief information about all cities over 1000 population; and a trade-name section.

MANUAL OF GEAR DESIGN, Section 3. By E. Buckingham. *Machinery*, New York, 1937. Cloth, 9 × 11 in., 172 pp., diagrams, charts, tables, $2.50. This third section of the "Manual of Gear Design" contains standards, formulas, and tables for designing helical, herringbone, and spiral gears. Preceding the mathematical content of the book is a section giving definitions of terms and standard symbols.

MANUAL ON RESEARCH AND REPORTS by the Committee on Research of the Amos Tuck School of Administration and Finance, Dartmouth College. McGraw-Hill Book Co., New York and London, 1937. Cloth, 5 × 8 in., 140 pp., $1.25. A little manual of wise advice upon the preliminary procedure and mechanics of investigating a subject, and on some of the important standards to be observed in presenting the findings. Writers of theses and research reports will find the book helpful.

MECHANICS. By W. F. Osgood. The Macmillan Co., New York, 1937. Cloth, 6 × 9 in., 495 pp., diagrams, tables, $5. This book constitutes a coordination of mathematical theory with physical principles. The first nine chapters give an extensive study of elementary mechanics from the physical point of view. The last six chapters and the appendix demonstrate the use of such mathematical tools as Lagrange's and Hamilton's equations in solving physical problems.

Merkbücher der Anstrichtechnik, Heft 5. Über das ANREIBEN VON FARBEN, by G. Zeidler. V.D.I. Verlag, Berlin, 1937. Paper, 4 × 6 in., 38 pp., illus., tables, 0.90 rm. A small manual on color grinding. Following a discussion of the general subject and the technical explanation are chapters on grinding and oil consumption, mechanical grinding of color materials, and material on the relation of pigments to agglutinants. A list of references appears at the end.

MOTION AND TIME STUDY. By R. M. Barnes. John Wiley & Sons, New York, 1937. Cloth, 6 × 9 in., 285 pp., illus., diagrams, charts, tables, $3.75. An analysis of motion and time-study techniques for finding methods of greatest economy and for measuring labor accomplishment. Special attention is paid to micromotion study, the principles of motion economy as related to fatigue and equipment design, and the determination of standards. Several pages of problems and a bibliography are included.

(The) PRACTICE OF LUBRICATION. By T. C. Thomsen. Third edition. McGraw-Hill Book Co., New York and London, 1937. Cloth, 6 × 9 in., 636 pp., illus., diagrams, tables, $6. A new edition of a standard work on lubrication. It is an engineering treatise on the origin, nature, and testing of lubricants, their selection, application, and use. The main part of the book is devoted to practical applications and use in numerous specific fields. An appendix treats very briefly the subject of skin diseases produced by lubricants, their prevention and treatment.

PRINCIPLES OF CHEMICAL ENGINEERING. By W. H. Walker, W. K. Lewis, W. H. McAdams, and E. R. Gilliland. Third edition. McGraw-Hill Book Co., New York and London, 1937. Cloth, 6 × 9 in., 479 pp., illus., diagrams, charts, tables, $5.50. A standard text-book on the subject. The general intention is to present basic operations common to many industries. This third edition has been revised to cover recent developments and data. Emphasis is laid on the importance of material and energy balances, equilibria and rate relationships, and the technique of their practical use.

PRÜFUNG IM LABORATORIUM UND ERFAHRUNG MIT EINSTOFF-, ZWEISTOFF- UND WÄRMEBEHANDELTEN SCHIENEN, by M. Ros and A. Eichinger. (Sonder-Abdruck aus dem Berichte der III. Internationalen Schienentagung, Budapest, 8–12 September 1935.) Ungarischen Verband fur Materialprüfung, Budapest, 1936. Paper, 8 × 12 in., 21 pp., illus., diagrams, charts, tables. This report gives the results of rail tests at the Swiss Federal Laboratory for Testing Materials, and of the results of practical trial use. Rails consisting of one and of two metals, both of natural hardness, and heat-treated rails were investigated.

(The) STORY OF TUNNELS. By A. Black. McGraw-Hill Book Co., New York, Whittlesey House, 1937. Cloth, 6 × 9 in., 245 pp., illus., $2.75. The development of the art of tunnel building is traced from the earliest times. The various methods of tunnel construction under different circumstances are described simply for the non-professional reader, mainly through descriptions of the construction of specific important tunnels.

Supplement to the Handbook BUTANE-PROPANE GASES. Second edition. Published by *Gas*, Los Angeles, Western Business Papers, March 15, 1937. Paper, 6 × 12 in., 70 pp., illus., diagrams, charts, tables, $1. This supplement contains a collection of articles on the liquefied petroleum-gas industry which have been published in the magazine *Gas* since the appearance of the second edition of the "Handbook of Butane-Propane Gases" in 1934.

SYNTHETIC RUBBER. By W. J. S. Naunton. Macmillan Co., London and New York, 1937. Cloth, 6 × 9 in., 162 pp., illus., diagrams, charts, tables, $2.50. Presents a brief history of the attempts to produce rubber synthetically and describes the characteristics of the more successful synthetic rubbers, including the technology and applications. The book concludes with a chapter on the future outlook.

TOOL ROOM GRINDING. By F. B. Jacobs. Penton Publishing Co., Cleveland, Ohio, 1937. Leather, 6 × 10 in., 221 pp., illus., diagrams, charts, tables, $3.50. Originally published as a series of articles in the magazine, *Abrasive Industry*, the chapters contained in this book have been designed to represent up-to-date practice. They cover tool-room grinding equipment, grinding operations on various tools, and the salvaging of small tools.

A.S.M.E. NEWS

And Notes on Other Engineering Activities

A.S.M.E. Spring Meeting at Los Angeles, Calif.

March 23-25, 1938

THE first of the A.S.M.E. Spring Meetings on the new four-national-meeting annual basis is scheduled to be held at Los Angeles, Wednesday, Thursday, and Friday, March 23–25, 1938, with headquarters at the Hotel Biltmore.

12 Sessions Ready

The Los Angeles Committee has been working zealously for several months in preparation for this meeting and in all 12 technical sessions are completed. Four of these sessions will be devoted to hydraulics, an important factor, of course, in the history and development of the great city of Los Angeles which now has the largest population of the Pacific Coast with well over a million people. There will also be sessions on fuels, aeronautics, management, applied mechanics, and petroleum as well as individual papers on tractors, the 200-inch telescope, and the technique of the motion-picture industry.

Visit to Motion-Picture Studios

On each day of the meeting a luncheon will be held and there will be two banquets. The first of these will be held at the Hotel Roosevelt on March 23 when talks given on the motion-picture industry will be followed by a private visit to certain motion-picture studios. This will be limited to 350 persons—members of the Society and their wives. The formal banquet of the meeting will be held on Friday evening, March 25. Further details on speakers at this function will be given later.

To provide for the local members in attendance who are unable to be absent from their business during the day three of the technical sessions will be scheduled for Thursday evening. At the time of going to press the following is the schedule by Divisions.

Aeronautics
- The Hydraulic Press at Douglas
- The Achilles Heel of the Dirigible

Applied Mechanics
- Design of Machine Columns

Fuels
- Technique of Burning Oil and Gas
- Fuel, Oil, Natural Gas, and Refinery Gas in Combustion Burners

Hydraulics
- Design of Pumps
- High-Speed Propeller Pumps
- Cavitation
- Erosion
- Modern Turbine Governing
- Kaplan Turbines at Bonneville
- Spillway Gates at Bonneville
- Deep-Well Pump-Testing Laboratory
- Hydraulic Jump

Petroleum
- Problems in Modern Deep-Well Pumping
- Design of Transportation Systems for Heavy Oil
- Modern Combustion Furnaces

Miscellaneous
- Mechanical Problems in Design of Diesel Tractors
- Mechanical Problems on 200-In. Telescopes

Trips
- Motion-Picture Studios
- Plant of C. F. Braun & Co.
- Oil Fields
- California Technical Pumping Laboratory
- 200-In. Telescope at California Institute of Technology, Mt. Wilson

In addition it is expected that there will be papers on airplane-vibration problems, management, deep-well drilling and pumping, and industrial instruments.

R. L. DAUGHERTY
Chairman, Program Committee

H. L. DOOLITTLE
General Chairman for Meeting

H. L. EGGLESTON
Secretary, General Committee

President Davis to Start His Section and Branch Visits on Jan. 12

DR. HARVEY N. DAVIS, president of the A.S.M.E., has received a number of requests to visit Local Sections and Student Branches of the Society. He has accepted just as many of these invitations as he possibly can. His first trip will begin on January 12, 1938, when he will leave New York for Washington, D. C.

In Washington he plans to spend three days at the annual meeting of the American Engineering Council, during which time it is hoped there will be an opportunity for the president to meet with the members of the Washington, D. C., Section.

In so far as arrangements have been completed, it is possible now to state that he will visit the places listed in the following itinerary. However, notices of such Section and Branch meetings as are yet to be arranged will be sent to the members from their own Local Sections.

- Jan. 13: Washington, D. C., Section
- Jan. 17: University of Virginia Student Branch
- Jan. 17 Richmond, Va., Section
- Jan. 18: Columbus, Ohio, Section, and Ohio State University Student Branch
- Jan. 18: Charleston, West Va., Section
- Jan. 19: Dayton, Ohio, Section
- Jan. 20: Cincinnati, Ohio, Section and University of Cincinnati Student Branch
- Jan. 21: Louisville, Ky., Section, and University of Louisville Student Branch
- Jan. 24: Indianapolis, Ind., Section
- Jan. 27: Peoria, Ill., Section
- Jan. 28: Chicago, Ill., Section and Lewis Institute Branch.

Tour to Los Angeles

All-Expense Four-Week Trip for Less Than $350; Trip Out by Rail, Return by Boat, Via Mexico, Panama, Havana

IN CONNECTION with the A.S.M.E. Spring Meeting at Los Angeles, Calif., March 23–25, 1938, arrangements have been made with the American Express Company for a conducted tour to cover the period from March 15 to April 11. Expenses for this tour have been figured from New York to New York with slight variations covering points east of Kansas City.

This tour to last approximately four weeks, including all transportation, meals (except those during the convention), hotel accommodations, sight seeing en route, but not at Los Angeles, for a sum varying from $300 to $350 according to accommodations required.

The price includes the trip on any main-line railroad between New York and St. Louis and Chicago where the group will be assembled, going on to join others at Kansas City. The return trip of about two weeks is based on tourist-cabin fares from Los Angeles to New York on the Panama Pacific Line *S. S. Virginia*, with stops at Acapulco, Mexico, Panama Canal, and Havana.

The all-inclusive rates with a choice of train accommodations going which will apply from any point to Los Angeles and return via the Panama Pacific Line to New York, plus railroad from New York to point of beginning are as follows:

Upper berth	Lower berth	Lower berth, 2 persons
$319.00	$323.00	$309.00
Compt., 2 persons	Draw. room, 2 persons	Draw. room, 3 persons
$335.00	$347.00	$331.00

Because of the limited time in which to complete arrangements, members are requested to write to the Secretary's Office, or to fill in the coupon provided on page 30 of the advertising section of this issue, and mail it at the earliest possible moment. Subject to slight modification, the itinerary proposed for the foregoing tour is as follows:

Itinerary

Wednesday, March 16

Leave Chicago, 9:45 p.m., or

Thursday, March 17

Leave St. Louis, 12:30 a.m.

Friday, March 18

Arrive Lamy, New Mexico, 5:45 a.m.
Lamy is the entrance into the Indian Pueblo District. After breakfast is served the group will leave on a sight-seeing trip by motor coach over the Indian Detour, with stops at Santa Fe, Tesuque, Puye, and Santa Clara Pueblo. Luncheon at La Fonda Hotel, Santa Fe. Return by motor to Lamy

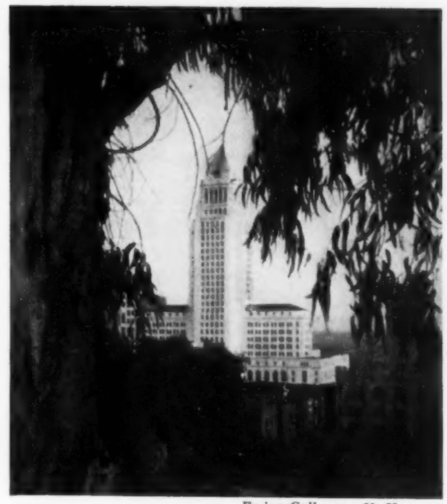
Leave Lamy, Mexico, 6 p.m.

Saturday, March 19

Arrive Grand Canyon, Arizona, 8:10 a.m.
Transfer to Hotel El Tovar where room or cabin and meals are provided. The first morning will be spent in a motor drive over the famous Hermit Rim Road, skirting the edge of the chasm. In the afternoon there will be a motor drive over the Desert View Road through the Tusayan National Forest.

Sunday, March 20

Leave Grand Canyon, 5:30 p.m.



Ewing Galloway, N. Y.

LOS ANGELES CITY HALL

Monday, March 21

Arrive Los Angeles, Calif., 9:10 a.m.
In Los Angeles, March 21–27

Sunday, March 27

Leave Los Angeles on the *S. S. Virginia*

Monday, March 28
to
Wednesday, March 30

At sea

Thursday, March 31

Arrive Acapulco, Mexico
Leave Acapulco, Mexico, 5:00 p.m.

Friday, April 1
to
Sunday, April 3

Cruising along the Coast of Mexico and Central America en route to the Panama Canal

Monday, April 4

Arrive Balboa, early afternoon
Western entrance to Panama Canal
Sight-seeing drive to Balboa, Panama City, and Old Panama

Tuesday, April 5

Leave Balboa, 6:00 a.m.
Daylight passage through Canal, arriving at Cristobal in the afternoon. Several hours ashore for sight seeing and shopping. Steamer sails at 7:00 p.m.

Wednesday, April 6
and
Thursday, April 7

Cruising Caribbean Sea en route to Havana

Friday, April 8

Arrive Havana, 8:00 a.m.
Comprehensive sight-seeing tour by car, visiting the principal points of the city and surrounding country.

Saturday, April 9
and
Sunday, April 10

Cruising Gulf Stream en route to New York

Monday, April 11

Arrive New York, Pier 61, North River, 9:00 a.m.

Ewing Galloway, N. Y.

THE PASEO, FAMOUS SPANISH STREET IN THE OLD PART OF LOS ANGELES

Actions of the A.S.M.E. Council at the 1937 Annual Meeting

THE Council of The American Society of Mechanical Engineers met on Monday morning, Dec. 6, 1937, in the rooms of the Society with President James H. Herron in the chair. The first item of business was the adoption of a resolution memorializing the achievements of Ambrose Swasey and recording his contributions to the effectiveness of the Society. This resolution, which was also adopted at the Business Meeting, will be found on page 69 of this issue.

The Council accepted the custody of a memorial to Calvin W. Rice which is to be kept in the rooms of the Society until it can be erected permanently in the lobby of the Engineering Societies Building.

The Annual Report of the Council (see pages 9 to 18 of this issue) was adopted for presentation to the Business Session of the Society in the afternoon of December 6.

Upon recommendation of the Executive Committee, which had been in session on the preceding day, the Council took the following actions:

(1) The following representative and alternates were appointed to American Engineering Council: Representatives: Harvey N. Davis, chairman, William L. Batt, Ralph E. Flanders, W. A. Hanley, and Eugene W. O'Brien. Alternates: L. P. Alford, A. L. Davis, Sabin Crocker, T. S. McEwan, G. F. McDougall, and W. H. Clapp.

(2) Acceptance by the Institution of Mechanical Engineers (Great Britain) of the invitation of this Society to meet in New York in September, 1939, during the Exposition was announced.

(3) The Local Sections Committee, in cooperation with the Committee on Meetings and Program, was requested to proceed with the preparation of preliminary plans for the Sixtieth Anniversary of the Society in 1940.

(4) A heat-transfer group was authorized.

(5) The December, 1937, revision of the Model Licensing Law, prepared by a Committee of the American Society of Civil Engineers, on which a number of other organizations were represented, was approved and adopted.

(6) A committee was appointed to consider the design of a certificate for the new fellow grade of membership.

(7) $6539 was appropriated from surplus to increase the Trust Funds, and $718 was appropriated for the Engineering Societies Library in accord with the uniform provision being made for the Library by the other participating societies.

Reports of Senior Councilors

The senior members of Council in each of the geographical areas of the country presented detailed reports of their contacts with sections and student branches in their areas. Discussion led to the conclusion that whenever possible the members of the Council should meet with the Executive Committees of the sections to discuss section problems.

"BLOWING POWDER," PHOTOGRAPH BY E. H. HULL FROM PHOTOGRAPHIC EXHIBITION AT THE 1937 ANNUAL MEETING

Extended consideration was given to the recommendations of the Admissions Committee of sixteen men under consideration for election to the new fellow grade in the Society. A procedure was adopted for the consideration of such recommendations. Discussion was principally devoted to the qualifications necessary for the fellow grade. Final decision was left until the meeting of the Council on Friday, Dec. 10, giving the members an opportunity in the meantime to study the records of the candidates which had been submitted to the members of the Council.

The Council adopted resolutions proposed by the Boiler Code Committee on the death of F. B. Howell, a member of the committee.

The Counci approved a meeting of the Society in Philadelphia during the first week in December, 1939, following a meeting in New York on the first Tuesday of December on which the election of directors will take place.

Council Reassembles Friday Morning

An adjourned meeting of the Council for 1937 was called to order on Friday morning, Dec. 10, in the rooms of the Society by President Herron.

The Council adopted a resolution of appreciation to all those who had contributed to the success of the 1937 Annual Meeting.

During the past year the Engineers' Council for Professional Development prepared a list of approved curricula in mechanical engineering in the schools of the country. The Society has a number of student branches in institutions which are not on this list. The Council adopted the policy of placing the branches at such institutions on a provisional status for a period not to exceed four years, during which time the institution would have an opportunity to improve its position and if possible go on the accredited list.

The installation of student branches at the University of Maryland and University of Arizona was approved.

The Society has a great many activities that are related closely to problems of education. A committee of ten was appointed to study the present situation and to make recommendations to the Council at its meeting in St. Louis. The personnel of this committee is as follows: Frank L. Eidmann, chairman, A. D. Bailey, C. J. Freund, H. P. Hammond, Wm. A. Hanley, J. C. Hunsaker, V. M. Palmer, Warner Seely, A. R. Stevenson, and W. R. Woolrich.

The Council approved the setting up of a general research custodian fund for unused balances remaining in other custodian accounts collected by special research committees.

A voluntary committee of men who had paid dues for more than 35 years and are now dues-exempt reported that as a means of aiding students and young engineers more than $600 had been collected from members who were exempt from dues, to be used for special prizes for students and to pay expenses of recipients of prizes in attending the Annual Meeting at New York.

The Committee on Aims and Objectives reported that it had started its work and in doing so had found that the question of engineering ethics seemed to be of prime impor-

tance. The Council approved the request that the Board on Professional Status and the Committee on Manual of Practice take early steps to formulate procedure for improving the administration of ethics in the Society.

The Council also approved routine recommendations of the Standardization Committee in regard to committee organization and of the Publications Committee for the distribution of the membership list.

To Meet in New Orleans, Feb., 1939

The Council voted to hold a meeting of the Society in New Orleans, Feb. 24 to 26, 1939.

The Council adopted a policy outlining the responsibilities of the Committees on Meetings and Program and Professional Divisions and of the individual divisions in program making.

Upon recommendation of the Local Sections Committee the Council approved a proposal of the Local Sections Committee whereby students transferring to Junior Membership may have fifteen months in which to complete this transfer without payment of a transfer fee.

Recommendations From Delegates

J. P. Harbeson, Jr., speaker of the Local Sections Delegates, presented informal recommendations which will be made later to the Council as a basis for action. In brief he pointed out the need for increased funds for local-section operations; the desirability of increasing travel allowances to include expenses; the importance of painstaking care in selecting new members, and the adoption of a scale of measurement for the performance of local sections. The Council expressed its deep appreciation to the Delegates for their helpful deliberations.

The election of Fellows was taken up where it had been left at the Monday meeting and after further discussion, the applicants were sent to ballot. This ballot closes on Jan. 3, 1938.

The Council received with appreciation an invitation from the American Society for Metals to participate in the National Metal Congress to be held in Detroit in October, 1938.

In closing, the Council voted its appreciation to its retiring members who had devoted painstaking efforts to the work of the Society.

1938 Council Meets

The Council for 1938 was called to order by the retiring president, James H. Herron, who introduced the following new members of Council: Vice-presidents, Bennett M. Brigman, Harte Cooke, Frank O. Hoagland, Warren H. McBryde, and L. W. Wallace; managers, Carl L. Bausch, Samuel B. Earle, and Frank H. Prouty, after which he presented the new gavel to President-Elect Dr. Harvey N. Davis who took the chair.

Council voted to appoint C. E. Davies, Secretary and W. D. Ennis, Treasurer of the Society for the year ending with the Annual Meeting of 1938.

The following men were appointed members of the Executive Committee of Council: Harvey N. Davis, Hoboken, N. J., chairman; James M. Todd, New Orleans, vice-chairman, Harte Cooke, Auburn, N. Y., Kenneth H. Condit, New York, and James W. Parker, Detroit, Mich.

The Senior Councilors for the year were announced as follows:

GROUP I: Samuel W. Dudley, New Haven
GROUP II: Kenneth H. Condit, New York
GROUP III: Harte Cooke, Auburn, N. Y.
GROUP IV: Edward W. Burbank, Dallas, Tex.
GROUP V: Bennett M. Brigman, Louisville, Ky.
GROUP VI: Walter C. Lindemann, Milwaukee, Wis.
GROUP VII: Wm. Lyle Dudley, Seattle, Wash.

The Council confirmed the appointment by the president of the personnel of the standing committees. The Council continued the following special committees: on Accrediting program, Citizenship, Economic Status of the Engineer, Freeman Fund, Manual of Practice, Mechanical Catalog, Membership Development, National Defense, Spirit of St. Louis Medal, George Westinghouse Bust, Westinghouse Memorial, and Board of Review.

The new Council gave some extended consideration to the matter of program making of the sections. This is a matter of extreme importance in the work of the Society.

Executive Committee Meets

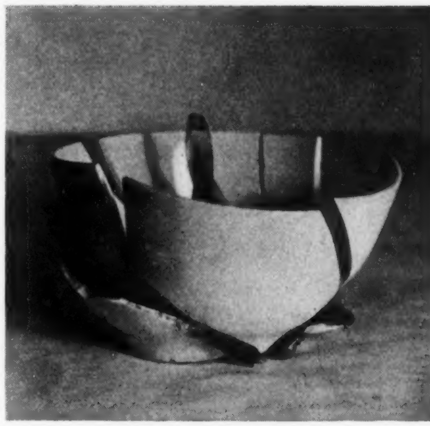
Following the Council meeting, the 1938 Executive Committee organized and established its dates of meeting for the first six months of the year 1938.

At the close of the Executive Committee meeting the senior councilors met and discussed the activities to be undertaken by the councilors in meeting with the sections and branches. In general, it was requested that each local section in each territory send advance notices of meetings both of the Executive Committee and of the sections to the new senior councilors. Each section is to be asked to give opportunity for the senior councilor to discuss section and Society problems with the Executive Committee as well as to meet with the membership in session.

Sanitation Symposium at Annual Meeting

IN connection with the 1937 Annual Meeting, a symposium on the adaptation and development of mechanical equipment for sanitary-engineering purposes was held under the auspices of the Process Industries Division. At this session, papers relating to mechanical engineering in sanitation, application of industrial experience to sanitation, and the mechanical background of refuse incineration were presented by Lewis V. Carpenter, N. B. Lund, and Henry W. Taylor.

Professor Carpenter, in his paper "Mechanical Engineering in Sanitation," points out that although sanitary engineering has been considered as a specialty within the field of civil engineering, the mechanical engineer has a distinct place in the sanitary-engineering field. Sewage treatment, incineration of industrial wastes, and industrial sanitation are all branches of sanitary engineering where a mechanical engineer with proper auxiliary training would be valuable.



WHAT HAPPENS WHEN A CUP OF COFFEE DROPS—PHOTO BY R. MERWIN HORN

"Industrial Experience Applied to Sanitation," by N. B. Lund, discusses mechanical equipment for sewage treatment which has features in common with mechanical equipment used in industry. Generally, industrial equipment must be considerably modified to meet the special problems of sewage treatment, but the two types of equipment are identical in some cases. Equipment which is somewhat similar to that used in sewage treatment is also employed in the treatment of trade wastes and water since both require the separation of liquids from solids, but the quantity of liquid handled and the ratio of liquids to solids is far greater in sewage treatment than in any industrial process.

Design, construction, and operation of incinerators for disposal of municipal refuse involve a large number of mechanical problems according to the paper "The Mechanical Background of Refuse Incineration," by Henry W. Taylor. Incineration, to some extent, parallels commercial-combustion practice but replaces the commercial element with a public-health factor and introduces many fuel characteristics which make it a special application of combustion principles that is best approached by utilization of mechanical principles to secure complete combustion of a special fuel and sanitary handling and disposal of municipal waste.

A limited supply of the individual papers remain in photo-offset form. Interested members may secure copies without charge, while the supply lasts, upon application to the Secretary, The American Society of Mechanical Engineers, New York, N. Y.

New Orleans Section

THE NEW Orleans Section of the A.S.M.E. is cooperating with the Louisiana Engineering Society in the annual meeting to be held on January 7 and 8, 1938, at the St. Charles Hotel in New Orleans, La. An interesting program is scheduled.

STANDING COMMITTEE ON LOCAL SECTIONS FOR 1938
(*Standing*, left to right: A. J. Kerr, Ernest Hartford, H. L. Eggleston. *Sitting*, left to right: D. B. Prentice, W. R. Woolrich, chairman, J. N. Landis.)

Standing Committee on Local Sections Confers at Annual Meeting

Meets With Group Delegates and Standing Committees

THE Committee on Local Sections was exceedingly active during the 1937 Annual Meeting holding conferences with various Group Delegates and Standing Committees of the Society, as well as with its officers. The entire Committee was present on these occasions, Messrs. W. R. Woolrich, chairman, D. B. Prentice, A. J. Kerr, J. N. Landis, and H. L. Eggleston.

The Committee decided that its individual members would visit a number of Local Sections and Student Branches in lieu of holding its usual spring meeting. Heretofore, it has been the practice to hold four Committee meetings a year but it was felt that greater benefits would accrue to the Sections and Branches through personal visits. Members of the Committee, therefore, will not hold another meeting until the Semi-Annual Meeting of the Society at St. Louis during the week of June 20.

At one of its conferences with the Standing Committees on Professional Divisions and Meetings and Program a plan was discussed whereby important developments in the various subdivisions of the field of mechanical engineering, as represented by the 16 professional divisions of the Society, will be presented as talks on Local Sections' programs.

Transfer From Student to Junior Grade

The chairman of the Committee, Dean Woolrich, will represent it at the Spring Meeting of the Society at Los Angeles, March 23–25. Details were discussed of an organized tour to this meeting which is described more completely elsewhere in this issue.

The Committee also gave much thought to the question of a better method for transferring student members upon graduation to the Junior membership grade so that these new Juniors might more quickly benefit from the Junior Group organizations now functioning in 34 of the 71 Local Sections. Through this proposal a student member may transfer to the grade of Junior immediately upon graduation at the same cost anytime within 15 months after graduation, that is, by September 30 of the year following his graduation. It is believed that more student members will thus be encouraged to become active in the Society as Juniors. It will be to a student member's benefit to accept membership even in the fifteenth month, if he cannot afford to do it earlier, since after the expiration period of the offer he will have to pay not only an initiation fee of $10.00 and $10.00 dues but will also have to file a *new* application.

A request was received from the Sections in Group VI for a re-grouping of Sections now in Groups IV and VI to bring together certain Sections in the Southwest which have a community of interest. This matter is to be given study pending the next meeting of the Committee at St. Louis.

Sixtieth Anniversary Celebration

The Committee made a recommendation to Council that inasmuch as the sixtieth anniversary of the Society's founding occurs on April 7, 1940, that a sixtieth anniversary celebration be planned. This celebration, it was suggested should take the form of sixty simultaneous meetings of Local Sections and Student Branches with a national broadcast lasting sixty minutes as part of the program. Council approved this recommendation and designated the Committee on Local Sections to take charge of the arrangements with the Committee on Meetings and Program.

Hugo Diemer, Chairman, Chicago Management Council

THE CHICAGO Section of The American Society of Mechanical Engineers in conjunction with seven other professional and industrial organizations is sponsoring the Chicago Management Council. Several interesting meetings were held last year and more are scheduled in the coming months. Each meeting is arranged and conducted by one of the participating organizations. Hugo Diemer, member, A.S.M.E., is chairman of the council.

Columbus Section Inspects Sewage Plant

THE members of the Columbus Section made a night inspection trip to the new Columbus municipal sewage disposal plant on Nov. 19, 1937. Since this $3,500,000 plant is well-lighted, the members were able to see and observe the various operations in the treatment and final disposal of the sewage.

Metropolitan Section Meeting, Jan. 11

Harvey N. Davis, President Guest of Honor

THE A.S.M.E. Metropolitan Section, will be the first to have the honor of entertaining the new President of the Society, Dr. Harvey N. Davis, at its midwinter get-together dinner on Tuesday, January 11, at 6:30 p.m., at the Roger Smith Restaurant, 40 East 41st Street, New York, N. Y. The toastmaster will be Frank M. Van Deventer, of the Walworth Co., New York.

Besides the opportunity to meet your President, Dr. Davis, the members of your own executive committee, your old friends, and new acquaintances, members of the Section will be given every encouragement to make any suggestions or to offer any criticism concerning the Section's interests.

Seating will be by Divisions to permit of easier acquaintance and there will be plenty of entertainment. You are urged not to miss this chance of spending a thoroughly enjoyable evening with other members of the Metropolitan Section.

The price is $1.25. Dress is informal. The affair is stag.

Junior Group Activities

Bridgeport Juniors Edit the "Junior Engineer"

NOVEMBER was marked by the appearance of Vol. 1, no. 1, of the *Junior Engineer*, published by the Bridgeport Junior Group under the editorship of C. A. Buss and W. E. Viscusi.

The first issue of this mimeographed paper contained news of the activities of the Group, and the first part of a brief technical article, "A Precision Grinding Machine." The author, C. A. Buss, discussed some of the factors involved in selecting the grinding wheel and described materials used in making wheels. This first section was closed with some data on speeds for wheel and work, and with a consideration of troubles resulting from improper speeds.

A trip to the Ansonia plant of the Farrel-Birmingham Company was mentioned in the news columns. This is the only plant of its kind in the vicinity of Bridgeport. Its heavy-duty products include three-high rolling mills with roller-lift tables, roll grinders capable of grinding to an accurate finish rolls 60 in. in diameter and 26 ft in length. Other products are 2000-ton hydraulic metal-forming presses, calenders for the paper mills, and Banbury mixers for the rubber and paint industries.

Real congratulations are due the members of the Bridgeport Group for sponsoring this publication and the editors for making good reading of it.

Chicago Juniors Take Part in Two Fine Programs

TWICE during December, Junior engineers of the Chicago Section combined their efforts with professional divisions to provide programs of novelty and interest. On December 7, in cooperation with the management and manufacturing divisions, a paper covering "Product Research" was presented by R. S. Archer, chief metallurgist, Republic Steel Corporation. The program included, in addition to Mr. Archer's talk, a round of questions concerning research in industry, organization of research problems, and relationship between management and research.

In the closing program for 1937 the Junior engineers, in conjunction with the power and fuels division, presented at the International House, University of Chicago, a novel program. After an afternoon's visit to the Museum of Science and Industry, members were directed to the International House where J. A. Folse delivered an illustrated lecture on "The History of Steam Power Development." The museum visit was confined mostly to the display of steam prime movers and provided an excellent background for the talk given later in the evening. Mr. Folse's talk to a great extent followed the history of steam power which has recently been published in Mechanical Engineering. The work of Hero, Branca, Newcomen, and Savery and their influence on Watts' later success was given in rather complete detail.

Demonstrations Enliven Toronto Group Meeting

THE ONE-year-old Toronto Junior Group is growing fast, as evidenced by a record attendance of 33 at the November 29 meeting. "Ingenious Mechanisms in Practice" was the subject of the evening, which was enlivened by actual demonstration of two ingenious devices. John T. West described the operation of a model combination lock and illustrated with slides some types of fireproof and burglar-proof safes which had been forced. Another junior, T. C. Agnew brought in a potentiometer temperature controller and explained the application of this electrical device to mechanical-engineering problems.

The Junior Thesis Competition was called to the attention of the members by the Group chairman, H. G. Hill. The Ontario Section is offering a prize of twenty dollars for the best thesis, in any branch of mechanical engineering. The competition is not limited to the strictly technical field, so that a study of a practical development is acceptable. In this way, an excellent means is provided for members to exchange ideas.

Novel Cooperative Papers Planned by Detroit Juniors

TO STIMULATE interest and to give each junior an opportunity to become better acquainted with his fellow member, the Executive Committee of the Detroit Junior Group, J. P. Schecter, Boyd Griffin, and W. B. Oakley, has worked out a novel program of cooperative paper writing.

According to the plan, four groups will be set up: Manufacturing and industrial, machine and tool design, power, and refrigeration and air conditioning. Juniors will be assigned to groups according to the member's present position. Each group will work on the preparation of a paper on some aspect of its field. Chairmen have been appointed to coordinate the individual thoughts into a workman-like presentation. If the papers are successful, it is hoped to present them before the Detroit Section.

The Executive Committee believes this plan will provide an occasion for the juniors to become more closely associated with each other, to discuss their common problems, and to increase their knowledge in the field of engineering in which they are engaged.

Seniors Cooperate With Kansas City Juniors

A NEW PLAN of cooperation between seniors and juniors has been meeting with remarkable success at Kansas City. Each member of the Executive Committee of the Kansas City Section is assigned to one meeting of the Junior Group. He may present something himself, or secure a feature of interest in addition to the program already scheduled. This arrangement has made meetings more attractive and has increased the interest of the entire Kansas City Section in the Junior Group. Average attendance at the monthly meetings is close to forty.

At the November meeting, Theodore Tobin, of the Group, presented a paper on the selection of cooling towers for several typical installations. Results of research work were discussed by Wilson Trapp, instructor at Kansas State College.

Metro Juniors Plan Trip and Seminar Meeting

"PRACTICAL Application of Electric Controls to Air Conditioning and the Year-Around Importance of Proper Air Distribution" will be discussed by C. N. O'Day, sales engineer, Preferred Utilities Mfg. Corp., at a meeting on January 18 of the air-conditioning seminar of the Metropolitan Junior Group. Sidney Davidson will serve as chairman.

The "Telegraph Capital of the World" as the Western Union Telegraph Company building at 60 Hudson Street, New York, N. Y., is known, will be inspected by the juniors on January 26.

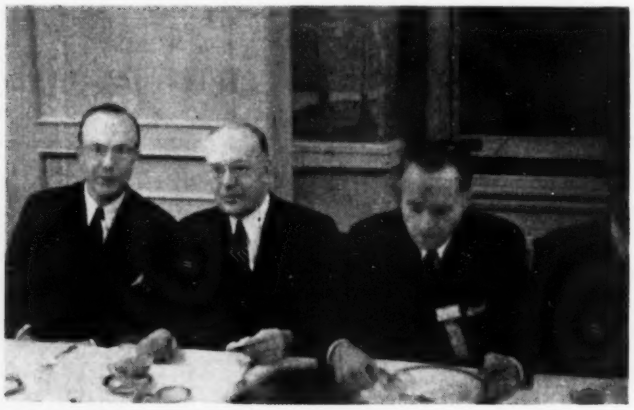
Social matters got their due share of attention on December 10, when the members and friends of the national defense seminar met for an evening's pleasure at the Broadway Hofbrau. Such get-togethers are a part of the seminar group's policy of providing opportunities for the members to become better acquainted socially; a policy that has been instrumental in building the group.

Detroit Group Inspects Tiremaking Plant

AN INSIGHT into the making of tires was gained by the Detroit Junior Group as the result of an inspection trip through the Detroit plant of the U. S. Rubber Company. Thirty-eight members and guests followed the rubber from crude state to the finished shoe.

Crude rubber from the plantations receives a careful inspection and goes through a complicated sequence of mixing and treating with various compounds. Meanwhile the fabric is being made and impregnated with latex, forming plies. Treads and beads are fabricated, and then all the elements, plies, bead, and tread, are put together, an operation known as "building" the tire. Shaping and vulcanizing complete the familiar product. The testing laboratories were also visited.

THE COUNCIL AND LOCAL SECTIONS DELEGATES TACKLE A BUFFET SUPPER SUNDAY NIGHT



R. H. MCLAIN AND W. A. SHOUDY APPREHENSIVE OF THE CAMERA. H. L. EGGLESTON OTHERWISE ENGAGED

R. L. FLANDERS SOLVING AN ECONOMIC PROBLEM (OR TELLING A STORY)

PRESIDENT HERRON HANDS C. F. HIRSHFELD WARNER MEDAL AS GEO. A. ORROK STANDS BY. ITALIAN AMBASSADOR DE SUVICH AT LEFT

PROBABLY TRYING TO SELL SOMETHING TO THE PRESIDENT

BEFORE THE SUPPER: (LEFT TO RIGHT) L. W. WALLACE, W. H. MCBRYDE, AND THE PRESIDENT, PARTIALLY ECLIPSING ALFRED IDDLES AND W. R. WOOLRICH

PRESIDENT-ELECT HARVEY N. DAVIS IN AN ATTENTIVE POSE WITH HARRY R. WESTCOTT LOOKING SKEPTICAL ABOUT THE CAMERAMAN'S INTENTIONS

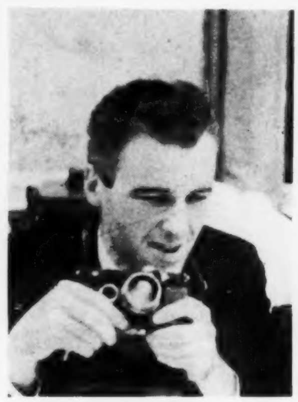
DANCING AT THE ASTOR—THE MOB SCENES HAVE SOMETHING TO DO WITH THE PAUL JONES

1937 A.S.M.E. Annual Meeting

POST-PRANDIAL GOSSIP: LEFT TO RIGHT, V. M. FROST, JOHN M. DRISCOLL, HARVEY N. DAVIS, AND J. N. LANDIS

W. R. WOOLRICH (RIGHT) TELLING C. P. HOWARD ABOUT TEXAS. S. B. EARLE AT LEFT

SECRETARY DAVIES EXPLAINING IT TO THE COUNCIL. W. A. SHOUDY AT RIGHT, WITH HARTE COOKE RELAXING IN BACKGROUND



CAMERA-MAN J. F. GUINAN CAUGHT AT HIS OWN STUFF

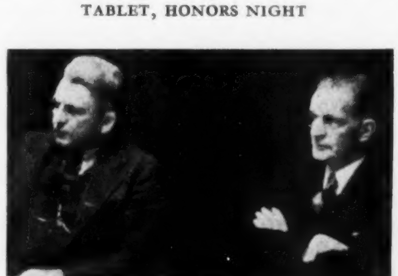
FRANK O. HOAGLAND LOOKING THOUGHTFUL AND KENNETH H. CONDIT EVIDENTLY AMUSED AT SOMETHING ACROSS THE TABLE

V. M. FROST AND J. M. DRISCOLL AT SUPPER

APPLAUDING R. D. YARNALL AT THE UNVEILING OF THE RICE TABLET, HONORS NIGHT

HARTE COOKE TELLS F. H. PROUTY A GOOD ONE

W. H. MCBRYDE TELLING THE EDITOR ABOUT THE ROYAL YACHT CLUB



JILES W. HANEY AND FRANK O. HOAGLAND IN ATTENTIVE MOOD

C. P. HOWARD CHECKING FIGURES FOR PAUL B. EATON

With the Student Branches

Streamlined Bulletin Board for Case Student Branch

DURING the last summer, an illuminated streamlined bulletin board was built in the school shop and placed in the mechanical-engineering building by the CASE STUDENT BRANCH. Lighted A.S.M.E. letters at each end of the steel case attract much attention. According to W. O. Williams, corresponding secretary of the branch, the board serves as a constant reminder of branch activities to old as well as prospective members. In order to accelerate the membership drive, the publicity committee developed an ingenious cardboard membership record gage which was patterned after a commercial recording instrument. On this gage is shown daily the membership percentage to the school enrollment for the upper three classes, and then separately for each of the three classes. Up to Dec. 6, 1937, the branch membership was 12 per cent higher than last year's total.

Committee on Relations With Colleges Holds Joint Meeting With Honorary Chairmen, December 8

Applications of Arizona and Maryland Approved, Bringing Number of Student Branches to 116

IN THE absence of Roy V. Wright, the 1937 committee chairman, William A. Hanley of Indianapolis, Indiana, presided when the Committee on Relations With Colleges met with the honorary chairmen on Wednesday, December 8, during the Annual Meeting. The Committee met again on Thursday morning to complete its business.

During the joint meeting, the applications of the University of Arizona and the University of Maryland to form student branches, were brought before the Committee which recommended to Council their acceptance, thereby bringing the number of student branches to 116. Other topics discussed at the meeting were the Student Group Meetings to be held in 1938, a report of the Committee on Relationship of A.S.M.E. to Accrediting Program of the E.C.P.D., cooperation of local sections in helping student members in their change to the junior grade, and finally recommendations to improve the student-branch news in MECHANICAL ENGINEERING.

At the meeting before the joint conference, Mr. Hanley was elected to serve as chairman of the Committee for 1938 and Alton C. Chick of Providence, R. I., was appointed as the new member to take the place of Dr. Wright whose term of office on the Committee expired with the Annual Meeting. Other members of the Committee are F. V. Larkin of Bethlehem, Pa., Huber O. Croft, Iowa City, Iowa, and Eugene W. O'Brien of Atlanta, Ga. Professors R. L. Daugherty of California Institute of Technology, E. O. Eastwood of the University of Washington, H. B. Langille of the University of California, R. S. Sink, University of Wyoming, and H. E. Degler of the University of Texas, were chosen advisory members of the Committee. C. K. Holland of New York, was appointed junior advisory member.

The Committee and Council were happy to note that the student membership up to Dec. 1, 1937, was 3953, which is 600 over last year. As evidence of the interest of student branches in the Annual Meeting, the Registration Committee informed the Committee that students were registered from the following schools: Montana State College, New York University, Rutgers, Stevens, Bucknell, Rensselaer, Vermont, Tufts, M.I.T., Brown, Columbia, C.C.N.Y., Lafayette, Pratt, Johns Hopkins, Newark, Pennsylvania, Case (Cleveland, Ohio), Brooklyn Poly, and Yale.

Student Luncheon at Annual Meeting Big Success

Talks by W. A. Hanley, J. H. Herron, and H. N. Davis

ABOUT 200 senior and student members attended the Student Luncheon held on Wednesday, Dec. 8, 1937, in the Rose Room of the Hotel Astor. Instead of being seated in school groups, the student members of each branch were purposely scattered among the various tables. This gave each student an opportunity to meet members from other schools. To each table were also assigned two senior members who have attained prominence in the Society and the engineering profession.

W. A. Hanley, Toastmaster

William A. Hanley, chairman of the Committee on Relations With Colleges, acted as toastmaster and presented Gino J. Marinelli, the recipient of the 1937 Undergraduate Student Award, and Allan P. Stern, the winner of the Charles T. Main Award for 1937. With so many prominent engineers present, it was impossible to present them all, so Mr. Hanley introduced only President James H. Herron and President-Elect Harvey N. Davis.

In a short talk, President Herron urged the members present to take back to their branches and fellow members his advice to maintain their membership in the Society, not only through school but also after graduation.

Advice on Job Hunting

This bit of advice was added to by Doctor Davis, the incoming president of the Society, who asked that the boys keep two things in mind while hunting a job. "Every job has its high spots and also its drudgery, usually 90 per cent of the entire job; therefore pick your job from the drudgery point of view, and then pick a job which you can idealize so that you would not be like the man who was willing to make shoes but not comic valentines." He then repeated President Herron's admonition

enlarging on the necessity of obtaining a perspective or understanding on why society membership should be continued. The students were asked to consider, not only the advantages of attending technical sessions, but also the friendships which one forms at these meetings. According to Doctor Davis, these friendships are valued by most members as much, if not more, than what they gain from the technical papers. The student members were advised to become acquainted with the junior members in their locality so that the transition from the student grade to the next one after graduation would not be so abrupt.

Student Members Assist at Annual Meeting

PART of the success of the technical sessions at the Annual Meeting was due to the fine work and assistance of the student members who assisted the technical committees. The boys helped to distribute preprints of the papers, registered the attending members and guests at each session, and assisted the chairman and recorder of each meeting very ably.

The names of these very able technical-session assistants together with their school affiliations follow: PRATT INSTITUTE—R. T. Haggerty, F. W. Fiala, W. M. Morsell, M. N. Kraus, J. L. Mullins, Jr., A. J. Mattson, N. F. Nadeau, and Clarence Roddy; NEW YORK UNIVERSITY—L. K. Swenson, R. L. Mueller, W. Schwartz, and S. Nooger; COOPER UNION—D. Russ, H. J. Kutzelman, J. E. Black, and C. Caccamo; BROOKLYN POLYTECHNIC—Chester Danowitz, Wilbur Eriksen, Donald Ritterbusch, and J. G. Morrow; NEWARK COLLEGE—W. G. Anderson, R. H. Frohboese, E. C. Nezbeda, and H. A. Rothbart; STEVENS—I. Sarlat, R. Miller, G. DeRossi, B. Harwood, R. Denzler, and O. Scheller; C.C.N.Y.—R. W. Pinnes, H. I. Steinmann, P. Pronsky, and I. Wechsler.

Branch News

Committee Appointments

THE chairman of the NEW YORK UNIVERSITY BRANCH (evening), M. J. Berg, announces the appointment of Messrs. Butzko, Merrill, and Guss to the program committee and Messrs. Jacobs, Shulman, and Rotondi to the publicity committee. . . . James Hardy, chairman, SOUTH DAKOTA STATE BRANCH, appointed Henry Callahan, Ralph Reeve, and James Stoner to the publicity committee and Maurice Vick, Fred Kratz, and Rodger St. Johns to the program and "eats" committee. . . . At VANDERBILT, two committees were formed, a program committee consisting of Ed Poste, William Martin, and Graham Finley, and a membership committee consisting of Don Jones, William Travis, and Douglas Dozier. . . . Lester McDowell, secretary, BUCKNELL BRANCH, reports the election of Robert Groover, Arnold Smith, and Robert Lewis to the program committee. . . . COLUMBIA has a "date" committee, for arranging the branch meeting days, comprising Messrs. Schmidt, Lyons, and Fassett, and a program committee composed of Messrs. Mitchell, Kiachif, and Taylor. . . . At MISSOURI the program committee consists of William Kunz, John Thurlo, Irwin Trowbridge, and Donald Gross.

Papers Presented by Members

PENN STATE BRANCH members heard C. L. Myers present and discuss a paper selected from MECHANICAL ENGINEERING. He stressed the fact that the magazine "is not of too technical a nature to be understood". . . . . At PRINCETON, Duncan Augustine talked on torpedoes and Joseph White spoke on the erection of steel framework. . . . . Frank DeLuca presented a paper on streamlining at a meeting of the RHODE ISLAND STATE BRANCH. . . . Members of SOUTH DAKOTA STATE BRANCH heard a talk on piping for food factories given by Edward Donahue. . . . Frank White, a senior member of U. S. C. BRANCH gave a paper on "Research on the High-Velocity Jet Pump" illustrated with slides. . . . TORONTO members were given a description of the 1937 Student Convention held at Columbus, Ohio, in a talk by I. W. Smith. At the same meeting, A. C. Hewson gave a talk on heat controllers, F. F. Walsh, discussed mine ventilation, H. D. Dick described some of his experiences in industrial insulation, and F. D. Ledgett followed him by speaking on insulation of buildings. . . . TULANE heard Herman Blum give a paper on "The Effect of Air Conditioning on Water Systems of Cities" in which he discussed the possibility of returning the condenser cooling water to the city's water-supply system. . . . The duties of an assistant station inspector on a railroad were described by Elias T. Lyman at a meeting of the VERMONT BRANCH, based on his employment in that capacity during the last summer. . . . At weekly meetings held at V.P.I., the members listened to discussions of topics, such as, "Stratosphere Versus Conventional Altitude Flying," "Air Conditioning of Residences and Small Offices," "When Should Motor Oil Be Changed?" and descriptions of various power plants. Among those taking part in these discussions were R. G. Gibbs, M. I. Wasserman, G. T. Jones, W. W. Bayne, F. R. Hommowun, E. G. Spyridakis, W. E. Austin, P. D. Dale, H. R. Puckett, C. A. Wagley, H. S. Miles, F. C. Green, J. A. Burke, C. H. Shorter, C. F. DeBusk, W. M. Pope, and H. P. Hoggard. . . . With a very small membership, the WEST VIRGINIA BRANCH maintains the interest of members by having three or four present papers at each of the weekly meetings. Among those who have talked are: A. Herold, P. R. Nufer, N. L. Turoff, P. A. Whalen, J. J. Teti, W. J. Brown, R. Abbott, A. H. Ritchie, C. R. Irons, J. M. Bland, J. B. Anderson, M. G. Clower, K. E. Pyle, D. E. Hornbeck and J. V. Balch. . . . At YALE, papers were presented by Warren Gray, F. H. Fowler, C. R. Fowler, R. A. Lorenzini, W. S. Kennedy, D. B. Irwin, B. L. Hutchinson, S. S. Board, G. Harrington, and W. Dawbarn.

More Talks by Members

Lester McDowell discussed before the membership of BUCKNELL BRANCH the advantages of being an A.S.M.E. student member. At another meeting, A. R. Smith gave a short paper on the Florida Ship Canal. . . . CALIFORNIA had Jack Palmer present a paper outlining foundry practice from the economical viewpoint. . . . At COLORADO, papers were given by Robert Simmering on the operations of a sawmill, by Carl Moore on his experiences during the summer in a machine shop, and by Robert Meyer on working for an automobile factory. . . . A very interesting paper was given on the history of the Diesel engine by Frank Sabec, member, COLORADO STATE BRANCH. . . . The COOPER UNION BRANCH conducted a meeting attended by 235 visitors who were mainly students in the evening division. Paul Weber gave a fine paper on the photo-offset process based on his personal experiences in the field. . . . A demonstration of a smoke tunnel was given by Charles Bassett to the members of FLORIDA BRANCH. . . . IOWA STATE COLLEGE BRANCH had Messrs. Codlin, Sandham, and Wallace collaborate on a paper discussing a proposed rotating valve adaptable to a steam engine to be used in an automobile. Other members who presented papers were Messrs. Knowles and Madson.

MICHIGAN STATE BRANCH has one or more meetings a week with many interesting talks being given by members. Among those who have presented papers are Joseph Lash, Osborne Cox, H. J. Milks, William Boardman, Floyd Ogden, John Long, Philip Sparling, Robert J. Barthold, Carl S. Lundgren, Edwin Smith, James Collins, R. W. Robinson, and Donald K. Scott. . . . MONTANA STATE members were privileged to hear Corry McDonald describe Diesel engines based on his experiences with them in the United States and Mexico . . . William Schwartz, member, N. Y. U. BRANCH, gave a very interesting presentation of materials handling at the Grand Coulee Dam, illustrated with slides from photographs taken by him. . . . NORTH DAKOTA STATE BRANCH heard Arthur Bjerken speak on Diesel engines. . . . Then at NOTRE DAME, Charles Hayes talked on the same subject while Joseph Moore described the manufacture of ball bearings.

Engineers Speak at Branch Meetings

M.I.T. had J. R. Colwell, Jeffrey Mfg. Co., give a lecture on the Grand Coulee Dam. . . . MICHIGAN held a meeting on Nov. 11, 1937, at which James H. Herron, president, A.S.M.E., was the guest speaker. Over 125 members heard him talk on "Some Engineering Experiences". . . . At MICHIGAN STATE, about 50 members and 50 visitors turned out to welcome President Herron the next day. He spoke on "Society Affairs and Activities". . . . G. E. Tomlinson, T.V.A., at a meeting of the MISSISSIPPI STATE BRANCH, spoke on the "Engineering and Construction Features of the Tennessee Valley Projects". . . . Maxwell C.

Maxwell, Yale & Towne Co., in a talk to the members of NEBRASKA BRANCH discussed materials handling. . . . Prof. Otto H. Henry of Brooklyn Poly spoke at a regular meeting of the NEWARK BRANCH. More than 75 members heard his talk on metals, including the design and causes of failure of various metals. . . . Both NEW YORK UNIVERSITY and PRATT considered themselves very fortunate to have William A. Shoudy, past vice-president, A.S.M.E. as a guest speaker at each of their meetings. The boys heard with a great deal of enthusiasm his talk on the A.S.M.E. and its relation to the engineering student. . . . The aeronautical division of the N. Y. U. BRANCH had a faculty member, A. N. Troshkin, give a very interesting discussion on the supercharging of engines at high altitudes. . . . N. Y. U. BRANCH (evening division) members learned all about color photography from Prof. E. H. Hamilton.

PENN STATE BRANCH had David L. Fiske, secretary, A.S.R.E., conduct an informal discussion on the necessary qualifications of a successful engineer. . . . L. K. Sillcox, member, A.S.M.E., gave a talk entitled "Things to Come in Transport" at a meeting of the PRINCETON BRANCH. . . . SOUTHERN CALIFORNIA BRANCH presented an all-engineering assembly featuring C. E. Wenland, Johns-Manville Co., in a talk on "Heat and Its Control," illustrated with motion pictures. . . . At TEXAS TECH, "all business was hurriedly dispensed with" so that the membership could listen to Bernard Zink, Winton Engine Corp., talk on Diesel engines. . . . Ferdi B. Stern, able corresponding secretary of the TULANE BRANCH, reports a very interesting illustrated talk given by John Mayer, honorary chairman of the branch, entitled "The United States Hydraulic Experimental Station at Vicksburg". . . . Ralph D. Baker, member of the faculty, gave a very educational lecture on the testing of airplanes by the use of wind tunnels and working models before the members of the UTAH BRANCH. . . . From WASHINGTON, comes a report of a talk on "Steam Power Plants of New York City" given by J. F. Pennel. . . . TEXAS A. & M. BRANCH members heard an interesting talk on the General Electric Co.'s employment system given by M. M. Boring. . . . Members of BROOKLYN POLY listened to a talk given by Professor Immediato "of the many opportunities, both technical and social, which are available to the enterprising engineer" in South America. . . . At an afternoon meeting of the CALIFORNIA BRANCH, the Johns-Manville motion picture "Heat" was presented and commented on by Messrs. Winlund, Osborn, and Randall. . . . "Mechanical Measurements by Electricity" was the subject of the talk given by Mr. Hathaway, G. E. Co., at a meeting of the CASE BRANCH. . . . Mr. Zahn, test engineer, Ex-Cello Corp., assisted by Messrs. Carr, Hoffer, and Scharer, presented a program at Detroit on the subject of fuel-injection systems for Diesel engines. . . . Preceded by motion pictures of the Pan-American Airways system, a talk, "Modern Commercial Aviation," was presented by Captain John H. Clemson, district manager for T.W.A., at a meeting of the DREXEL BRANCH. . . . "Machine Design" was discussed at a meeting of the LAFAYETTE BRANCH by James Fairhurst of the Ingersoll-Rand Company.

Joint Meetings

In cooperation with the Junior Group of the Cleveland Section, a meeting was held by the CASE BRANCH at which several motion pictures were presented by a representative of the Ford Motor Company. . . COLORADO BRANCH in a joint meeting with the A.I.E.E. student branch, heard various student members, and engineers of General Electric and the Colorado Public Service Co., describe tests carried out on a new unit recently installed at the school . . . A joint meeting of the LEHIGH BRANCH and the Lehigh Physics Society presented J. A. Fitz, Sperry Gyroscope Co., who gave an illustrated lecture on "Gyroscopes in Industry" . . . At a meeting sponsored by the MISSISSIPPI STATE BRANCH, G. E. Tomlinson, T.V.A., spoke on the engineering projects of the T.V.A. to an assemblage of engineering students—mechanical, electrical, chemical, and aeronautical. . . . An open meeting was held under the joint sponsorship of the PENN STATE BRANCH, the Penn State Physics Society, and the Central Pennsylvania Section of the A.S.M.E., at which Johns-Manville representatives presented the sound motion pictures "Heat" and "Transite Pipe for Water Lines". . . . RENSSELAER BRANCH conducted its November meeting in conjunction with the Society of Engineers of Eastern New York. Following a dinner, the members heard an interesting and educational lecture on electric welding by James F. Lincoln of the Lincoln Electric Company. . . . The TULANE BRANCH had a joint meeting with the Tulane Glider Club, at which Don M. Halley, member of the faculty, gave a brief history of aviation embellished with anecdotes of his personal experiences. . . . YALE BRANCH in cooperation with the student branch of the A.I.E.E., presented the second talk in their lecture series. Developing his topic, "Culture and Human Nature," Prof. George D. Murdock described the ties and hindrances that society places upon itself and explained their origin and effect.

Members Make Inspection Trips

The members of LOUISIANA STATE BRANCH made a night-inspection trip through a steam power plant. . . . MARQUETTE made another of its educational trips; this time through a heat-treating plant. Prior to the inspection, company officials showed motion pictures of the various processes and explained the different methods. . . . M.I.T. inspected an electric power plant. . . . About 25 members of the MICHIGAN STATE BRANCH spent an entire day in Detroit, visiting the automobile show, going through the Chrysler Engineering Laboratories, and then being guests of the company at a turkey dinner in the evening. . . . A one-day inspection trip was made by NEBRASKA to Omaha where the members inspected the Swift meat-packing plant, had lunch, and then visited a power company and the local plant of the American Smelting Company in the afternoon. . . . NORTHEASTERN went through the Harvard Hospital's power plant, where, besides the boilers, the student members also saw emergency electric-generating units and a modern refrigeration system. . . . A group of members of the PRINCETON BRANCH made a trip to Eddystone, Pa., where they inspected various plants. On the way back, they stopped in Philadelphia and finished off the day with pretzels and beer. . . . believe it or not, members of the VERMONT BRANCH went through an iron mine in New York State in a place called Mineville. According to Clinton Renfreu, the corresponding secretary, there are approximately 1500 men employed in and around the mine. . . The evening division of N. Y. U. made an inspection trip through the steam-generating plant of the New York Steam Corp. which sells steam to buildings just as an electric company sells electricity. . . . DREXEL BRANCH conducted an inspection trip through the Westinghouse Electric & Manufacturing Company plant. . . 30 student members of V.P.I. made an inspection trip to two of the large power plants in the southwestern part of Virginia. . . . TULANE made an inspection trip to the International Harvester Company's twine mills where the process of making twine and rope was followed from the hemp warehouse to the final wrapping of the bundle of cord or rope in the shipping room. . . . COLORADO visited a power plant and a coal mine. . . . Members of PRATT went through the power plant and shops of the New York Hospital. . . . Senior members of IOWA STATE BRANCH described their recent inspection tour through a packing plant, a steel plant, and a power plant.

This and That

Will the corresponding secretary of TEXAS A. & M. please give the full name of his school, instead of just putting down A. & M. College on his reports. . . . MARQUETTE BRANCH has again sponsored an annual flower sale to raise money for a scholarship fund. Congratulations on your fine work. . . . We hear that VERMONT BRANCH scheduled a debate with the student branch of the A.I.E.E. on the question, "steam is better adapted to railroad motive power than is electricity". . . . MONTANA STATE has some very interesting meetings even though they are held during the lunch hour. Members bring their lunches in paper bags and eat during the meeting. At the first meeting of the school year, various pieces of apparatus were demonstrated in a "spectacular manner" for the purpose of stimulating the interest of new members and guests in the activities of the branch. At another meeting, Professor Therkelsen read portions of letters from recent graduates in which the advantages of affiliating with the A.S.M.E. while in school were stressed, mainly the opportunities opened up through such membership. . . . MISSOURI BRANCH recently split the office of secretary-treasurer into two separate offices. Melvin Yedlin, formerly secretary-treasurer, was elected treasurer and Frank L. Havel was chosen secretary. . . . N. Y. U. (evening) has been able to maintain almost 100 per cent attendance of members at meetings by presenting interesting programs at each and every session. . . . MICHIGAN BRANCH held its annual "Roast" on Dec. 15, 1937. At this affair, the student members exercise the almost unheard of privilege of "razzing" their instructors and professors.

Other Engineering Activities

A.S.A. Holds Annual Meeting

Dr. Jewett Speaker at Luncheon

ROUNDING out its nineteenth year of service as national standardizing agency, the American Standards Association at its annual meeting on Dec. 1, 1937, at the Hotel Astor, New York, reported the largest increase in membership of any year since the Association was formed.

Dana D. Barnum, president, announced that in the last 12 months, 16 new national groups have affiliated. Several are in the building field, and two in the automotive. The National Retail Dry Goods Association with 5800 store members is the first retailing group to affiliate. The American Standards Association is a federation of national groups dealing with standardization. Through it government, industry, labor, and the consumer work together to develop mutually satisfactory national standards. It acts as the authoritative channel for international cooperation in standardization work.

Fifty-nine standards have been approved during the year. Among the more significant of these is the Standard for Railway Grade Crossing Protection developed by the Association of American Railroads. This standard marks the fifth important one in the field of traffic safety to be approved by the Association to date.

In the mechanical field the new American Standard for Large Rivets has been approved and published, bringing to completion 11 years of work on the part of a representative committee of manufacturers, users, and technical experts. The year has also seen completion of four important standards which provide for greater interchangeability in the use of certain machine-tool elements.

In the electrical field, the Elevator Safety Code has been revised, incorporating many new provisions for safe practices in elevator design and operation, made as the result of research carried on at the National Bureau of Standards for the elevator industry.

Among the important revisions completed during the year, are the National Electrical Code and the American Standard for Compiling Industrial Injury Rates. This last provides a method of comparing accident statistics of departments, jobs, and workers. The same committee that developed this is working on a standard practice for collecting accident causes, which will soon be published for trial use.

The Safety Code for Power Presses, one of the first and most important standards in the field of industrial safety, has also been revised during the year.

The 59 standards added this year bring the number of American standards to a total of 382, approved since the Association was organized in 1918 to act as a clearing house for the many standardization activities of trade associations, technical societies, and government bureaus in this country.

Three new building projects, Administrative Requirements for Building Codes, Requirements for Excavations and Foundations, and Requirements for Iron and Steel, have been authorized during the year, making a total of eight active projects in this field. "As a national clearing house for this work," said Mr. Barnum, "the American Standards Association has an opportunity to perform a real service. Housing and construction form the greatest single problem before the country today." By removing unduly restrictive regulations opening the way for use of new materials and new methods, Mr. Barnum felt that the association could do its bit in the solution of this great problem.

In connection with its international work, the American Standards Association has been invited to fill a vacancy on the Council of the International Standards Association; and at the meeting of the Board of Directors, P. G. Agnew, secretary, American Standards Association, was appointed the official A.S.A. representative. Through the American Standards Association, business interests in this country are participating in a number of international projects, among them automobile parts, petroleum products, and systems of machine fits. The adoption last year of the standard developed by the American Society of Motion Picture Engineers as world standard, the international standardization of bearings, the inch-millimeter conversion tables, have already pointed the way to what can be accomplished through cooperation with the other industrial countries throughout the world.

Following a luncheon at the Astor, Frank B. Jewett, vice-president, Bell Telephone Laboratories, spoke on "Thirty Years of Standardization in Retrospect."

Officers elected for 1938 are: Dana D. Barnum, past-president, American Gas Association, and member of the Board of the A.S.A. since 1933, president (reelected), and Edmund A. Prentis, of Spencer, White & Prentis, Inc., New York, vice-president (reelected). F. M. Farmer, member, A.S.M.E., was reelected chairman of the standards committee.

Leipzig Spring Trade Fair, March 6–14, 1938

THE Leipzig Fair will be held March 6–14, 1938. To accommodate new exhibits two halls, with over 200,000 square feet of display space, will be added to the 51 exhibition halls heretofore in use. The Spring Fair will include some 10,000 exhibits of industrial and art products from 21 countries including the United States.

Institute of Ceramic Engineers Organized

DURING the past several years various states began to license engineers and the E.C.P.D. started its program of accrediting engineering schools. In these movements, the ceramic engineer was not being considered or even recognized except to a limited extent. To meet this situation and to bring recognition to the ceramic engineer, Keramos (the honorary ceramic engineering fraternity), through the activities of Prof. A. F. Greaves-Walker, petitioned the Board of Trustees of the American Ceramic Society for permission to form an organization of ceramic engineers within the society. This request was granted and the constitution and by-laws of the society were amended to provide for a class in the society to be known as The Institute of Ceramic Engineers of the American Ceramic Society.

The institute was initiated by certain members of the society who formed a group to be known as the Founders' Group. After months of preparing details of organization, drafting of rules, etc., the group has named various committees which will help to get the organization started in the early part of 1938. Membership in the institute is now being offered to all those who can meet the entrance requirements. The first meeting of the institute is to be held during the annual meeting of the American Ceramic Society in New Orleans, La., March 27 to April 2, 1938.

United Engineering Trustees Annual Report

THE annual report of the United Engineering Trustees, Inc., for the fiscal year ended Sept. 30, 1937, was presented to the Board of Trustees at the annual meeting held on October 28, 1937. The corporation is charged with the funds and operation of joint properties of the four Founder Societies, the Engineering Societies Building, the Engineering Societies Library, and the Engineering Foundation.

A summary of the 1937 report together with a brief financial statement follows:

During the year, the corporation lost two of its most esteemed members, namely Dr. Alfred Douglas Flinn, on March 14, and Dr. Ambrose Swasey, on June 15. It is noted in the report that since the death of Doctor Swasey, his estate has notified the corporation that one of a number of trusts created during his life time designated United Engineering Trustees, Inc., to receive as part of his gift heretofore made to The Engineering Foundation about $100,000; thus bringing the total of his gifts to approximately $850,000. Doctor Swasey, in his eagerness to improve conditions for his fellowmen, founded The Engineering Foundation in 1914.

The Engineering Societies Building, of which the corporation is titular owner and custodian, is in its thirty-first year of activity as the headquarters of the engineering profession. It remains in good physical condition with a minimum of repairs and maintenance expense. Meeting-hall facilities on the fifth floor have been increased through minor im-

provements. This makes available to the societies additional space for the annual meetings and for Metropolitan-section activities which has been greatly needed.

The corporation remains treasurer for the Engineers' Council for Professional Development and custodian for the John Fritz Medal Fund, the Engineering Societies Employment Service, Relief Fund for Unemployed Members (formerly Professional Engineers' Committee on Unemployment), and Engineers' National Relief Fund.

A new edition of History, Charter and By-Laws of the Corporation, the first since 1931, was issued just prior to the close of the fiscal year, and gives much of historical and legal interest not only to the trustees and members of the Founder Societies, but also to any person who may wish to make a gift or bequest to the corporation or its departments for the advancement of science and engineering.

The value of the assets of the United Engineering Trustees, Inc., as attested by its balance sheet dated September 30, 1937, was $3,496,361.30. This amount included:

Real estate	$1,987,793.92
Endowment funds and investments	1,448,475.88
Operating assets	23,476.75
Temporary investments and unexpended income of various funds	36,614.75
Total	$3,496,361.30

The Combined Fund (which includes The Engineering Foundation Fund, Edward Dean Adams Fund, Library Endowment Fund, Depreciation and Renewal Fund and General Reserve Fund) and the Henry R. Towne Engineering Fund, showed an increase in principal of $43,000 (book value) over the previous year. The balance sheet does not include the value of the library, which was appraised at $480,600 in 1937, or the Founders' interest therein.

North Carolina Engineers to Hold Institute Meeting

On Jan. 27, 1938, the School of Engineering of the North Carolina State College in cooperation with the North Carolina Society of Engineers, is holding an Institute for Engineers. The purpose of the Institute is to bring together a specific group interested in a common subject for a period of intensive instruction in order that they may keep up to date or become more proficient in their work. The list of speakers and lecturers includes Dean J. W. Harrelson, Dean Blake R. Van Leer, Dean W. C. Riddick, Prof. A. F. Greaves-Walker, Prof. W. G. Van Note, Prof. C. M. Heck, Prof. L. L. Vaughan, Prof. J. L. Stuckey, and Dr. Dugald C. Jackson. Dr. Jackson will discuss "The Inseparability of Engineering and Civilization."

Following the Institute for Engineers, the North Carolina Society of Engineers will hold its annual winter convention on Jan. 28 and 29, 1938, at the Carolina Hotel. Speakers for non-technical sessions will be Dr. Jackson and E. W. O'Brien, past vice-president, A.S.M.E.

Engineering Societies Library 1937 Report

The Engineering Societies Library report for the fiscal year ended Sept. 30, 1937, covers a year of quiet, steady activity along normal lines, not marked by any unusual occurences of great magnitude. It is gratifying to know that the library is becoming more and more a bureau of engineering information with a clientele that is not only national, but world-wide.

The following abstract from the report stresses the high lights of the activities of the library for the past year:

Physically, the most pressing need is more shelving. The present bookstacks will be filled within a short time. Sufficient floor space is still available to relieve the situation for the next four or five years.

Early in 1937, a microfilm copy of the library catalog was made and deposited in a bank vault for safekeeping. From this film, duplicate card catalogs can be made at any time by a simple photographic process. Possession of the film has made possible an important reduction in the amount of insurance carried and so effected a continual annual saving of expense.

Use of the Library

The number of readers was 26,750. In addition 10,227 nonvisitors were supplied with information and material in the following ways: Loans, preparation of bibliographies, translations and photocopies, and information by letter and telephone. In all, 36,977 persons used the library. The previous year, 37,586 persons availed themselves of the library facilities.

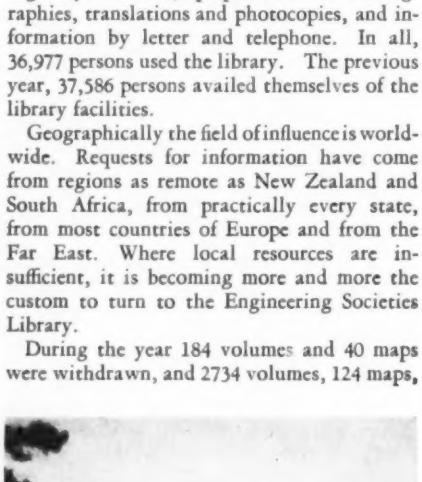
Geographically the field of influence is world-wide. Requests for information have come from regions as remote as New Zealand and South Africa, from practically every state, from most countries of Europe and from the Far East. Where local resources are insufficient, it is becoming more and more the custom to turn to the Engineering Societies Library.

During the year 184 volumes and 40 maps were withdrawn, and 2734 volumes, 124 maps, and 64 bibliographies were added, bringing the total at the end of the year to 141,292 volumes, 7330 maps, and 4362 searches. In addition 3701 pamphlets were added. The lending collection contained 660 volumes at the end of the year, and approximately 10,000 duplicate volumes and pamphlets were in stock.

Substantial progress has been made in the periodical index, which is intended to provide a minutely classified guide to the important periodical literature of engineering. Over 20,000 references were added to the file, which now contains 187,000 references to material published during the past ten years.

A.S.M.E. Members of Library Board

The three members of the A.S.M.E. on the Library Board for 1937–1938 are A. R. Mumford, John Blizard, and W. H. Winterrowd. Mr. Mumford is vice-chairman of the Board.



GRAND CANYON—EARTH'S SCENIC MARVEL
(En route to A.S.M.E. Spring Meeting at Los Angeles. See pp. 94 and 95.)

Annual Meeting of Heating and Ventilating Engineers

During the week of Jan. 24, 1938, heating, ventilating, and air conditioning will receive considerable attention in New York City. At that time, the American Society of Heating and Ventilating Engineers will hold its forty-fourth annual meeting at the Hotel Biltmore, the midwinter meeting of the National Warm Air Heating and Air conditioning Association, and the annual meeting of the American Society of Refrigerating Engineers will be in session at the Hotel Roosevelt, and the Fifth International Heating and Ventilating Exposition will be in progress at the Grand Central Palace.

Technical sessions will be held by the American Society of Heating and Ventilating Engineers on Jan. 25 to 28, inclusive, in the morning with a joint session in the afternoon of Jan. 25 with the National Warm Air Heating and Air Conditioning Association and another, in the afternoon of the following day, with the American Society of Refrigerating Engineers. An inspection trip to the Lincoln Vehicular Tunnel is scheduled for the afternoon of Jan. 27. Dinners and entertainment, in some of which all three societies will participate jointly, are planned for the four evenings.

Council of Commercial Laboratories Formed

Representatives of 20 of the principal commercial laboratories of the country, at a meeting in Chicago in the early part of November, completed the organization of the American Council of Commerical Laboratories. Members to the council have been and will be carefully selected to include only organizations to which producers, retailers, and consumers may look for unbiased testing and research uninfluenced by any ulterior consideration. James H. Herron, past-president of the A.S.M.E., was elected a member of the executive committee.

American Engineering Council

The News From Washington

Federal, State, and Local Planning

OPERATIONAL planning of public enterprise is becoming universal in the United States, according to the annual report of the National Resources Committee released Nov. 10, 1937; and it is indicated that serious efforts are now being made to determine the "strategies of civilizations" and to provide national, social, and economic policies for present and future generations. Engineers congratulate the National Resources Committee and all state and local planning bodies on their good judgment in the adoption of the planning function, but many of those who are most experienced in planning operations question the value of national planning which involves the determination of a pattern of living for future generations.

In reviewing its efforts to stimulate planning and to encourage decentralization of planning activities, the National Resources Committee has pointed out that, in addition to the 46 state planning boards, there are now approximately 400 county planning agencies and more than 1700 similar groups in towns and cities. The committee predicts that state planning boards will increase their resources and usefulness through closer cooperation with other planning bodies, and expand their activities as state legislatures increase planning appropriations. Of the 1700 municipal planning or zoning agencies, some 1200 have continuous planning boards for making adjustments in zoning ordinances and for initiating plans for physical improvements including public buildings, parks, thoroughfares, and the better use of available resources.

Secretary Ickes, in his letter to President Roosevelt transmitting this report, states that "continuous planning is needed for the conservation and wise development of our national resources—both natural and human. With new inventions, new ideals, and new discoveries, no fixed plan or policy will suffice, for any rigid mold or blueprint plan, if strictly adhered to, may restrict our freedom rather than enlarge it. If we adopt as our constant objective to hand down to our children an unimpaired physical inheritance in the natural wealth of this continent, then we must make new plans to meet new conditions."

Many engineers are likely to welcome the philosophy that "no fixed plan or policy will suffice," and most of us will agree that any effort to mold our future may "restrict our freedom rather than enlarge it." Member societies should congratulate Secretary Ickes and encourage him to have that principle firmly established as the guiding influence for the National Resources Committee and all of its subcommittees. In that way, engineers and engineering organizations may be constructive in their efforts to prevent the enforcement of misguided attempts to predetermine an exact plan of social and economic life for unborn generations of our citizens.

On the subject of regional planning, the National Resources Committee says that "there have always been interstate problems, and we have always had to use some kind of negotiation or planning to meet the critical situations as they arise. It is, therefore, nothing new to have interstate compact commissions and planning agencies studying alternative methods of solution for pressing problems which involve more than one state." The report then proceeds to name a number of regional-planning activities and "demonstration projects" in the central Northwest, New England, the Ohio Valley, and the Pacific Northwest where it is said that real progress is being made on such problems as flood control, reclamation work, power policy, etc. A limited number of copies of the report are available, and members may obtain them directly from the National Resources Committee, Interior Building, Washington, D. C.

United States Housing Authority

NATHAN STRAUS, who is listed in "Who's Who in America" as a "merchant," has been chosen for the unusually powerful position of administrator of the United States Housing Authority. He is president of Nathan Straus & Sons, Inc., president of the Hillside Housing Corporation of New York City where he has used his own funds in a successful housing experience, president of the Nathan Straus Foundation, and in addition to an active interest in agriculture, conservation, and taxation, Mr. Straus was commissioned by the City of New York to make a European housing survey in 1935.

Recognizing a valid public interest in the authority, Mr. Straus has announced a number of principles for the guidance of his administration. Most encouraging of these is his decision "to get our policies set" before entertaining applications for housing loans and grants from state and municipal authorities. In the meantime, conferences may be held in those communities where there is actual need for more suitable living quarters for low-income groups at prices which families of extremely limited incomes can afford to pay.

Construction costs of new projects are to be kept at a minimum. Some housing authorities regret the limitations in construction costs of from $1000 to $1200 per room established by Congress, but Mr. Straus has indicated that he does not feel handicapped by such restrictions and expects to see considerable expansion in housing of the slum-clearance type. There are indications, too, that the maximum subsidies allowed by the Act will not be granted in all cases. In that way, annual contributions may be restricted to the amounts actually necessary to assure the low-rent character of such undertakings.

Strict adherence to these and similar policies is likely to supplant fear with hope in the building industry. Private enterprise has been unable to materially improve living quarters for families of such limited incomes, and as a result there is a potentially large undeveloped market for residential construction in this particular field. It is thought that federal aid, under proper safeguards, for those municipalities who may undertake low-rent housing programs, will not only avoid unfair competition with the building industry, but may stimulate a demand for better houses for such purposes and suggest, to private development companies, ways and means of reducing costs to a point where they may be able to enter the market.

As a matter of fact, the United States Housing Authority is not likely to add greatly to the total of dwellings available to such people. The act provides that subsidies for new houses shall not be granted unless the project involves elimination or improvement of a "substantially equal" number of unsafe or unsanitary dwellings. In the beginning, at least, there is a strong disposition to enforce such destruction of slums in all cases. Under these conditions, the slum-clearance program and the long-sought recovery in private building for families of average income may go forward at the same time.

Construction of Public and Private Works

CONSTRUCTION, public and private, the building of homes, and the difficulties of the allied industries are centers of official and unofficial discussion at this time in Washington. The Administration and many of those called upon to prescribe remedies for the current recession in business are reported to be turning to the building phases of the construction industry for a solution. Sociologists stress the increasing need for decent housing facilities, economists emphasize far-reaching possibilities for employment in the construction of residences, and both labor and capital agree that industry in general would be greatly stimulated by the inauguration of a "private-home-building campaign" and further encouragement of publicly financed residential construction.

Conferences are being called inside and outside of government circles to find ways and means for restoring business confidence, and much attention is being directed to those industries engaging in the production and fabrication of materials going into construction. Likewise, studies are being made of the labor situation in construction on the site and in production organizations behind the lines. Recent advances of 10 per cent to 15 per cent in the costs of both material and labor are being investigated by government authorities, among whom there are

unmistakable evidences of a change in spirit and attitude. Some of those who have heretofore busied themselves with emergency public construction are becoming aware of the fact that they have neglected to cultivate private business initiative.

Such activities are being welcomed as evidence of an "administration discovery" that prosperity in business actually makes jobs, creates wealth for national stability and the profits on which all government lives. It is expected that the more constructive thinking may appeal to private industry and induce private organizations to accept a public invitation to undertake to supply the demand for more homes of the better type and more adequate housing for low-income families. In that way, both public and private sponsors of the housing program expect to help restore prosperity and also accomplish a desirable social objective, without resorting to "pump-priming" of less immediate benefit to the economic and social welfare of the people.

Why a Public-Works Department?

COMMENTING editorially on a fine article in its Nov. 11, 1937, issue by Mr. Alonzo J. Hammond, who is vice-president of the American Engineering Council, the *Engineering News Record* had the following to say on "Performance and Preparation:"

A cogent summary of the conditions and reasons that underlie the government for a national public-works department is given in this week's leading article, from the pen of A. J. Hammond, past-president of the American Society of Civil Engineers. It should bring home to every engineer that his own fortunes are involved in the question. Efficient, centralized direction of our national public works will of course make public-works construction more efficient and economical; but in addition it will render systematic advance planning and budgeting of federal construction possible, as was brought out in this column a few weeks ago. Through such planning the government will be enabled to hold public works ready for the call of business emergency. The lesson learned during the past half-dozen years, when the collapse of construction threw engineers by the thousands out of work was that the stabilizing power of public-works construction should be held ready for service. A central works department under competent direction would go far to assure this stabilization.

Eighteenth Annual Meeting

MEETING in the Mayflower Hotel in Washington, D. C., on Jan. 14 and 15, 1938, the Assembly of the American Engineering Council will represent the largest membership in its entire history—fifty engineering societies. Engineers representing societies from one coast to the other are being scheduled to discuss legislation of vital importance to the profession and problems in public affairs which are of major concern to the general public welfare.

Every engineer who may be in Washington, D. C., on the evening of Jan. 14, 1938, is invited to the informal All-Engineers' Dinner in the ballroom of the Mayflower Hotel. Following the dinner, for which reservations should be made in advance, an engineer executive who is known to the entire nation will address the meeting on the current situation in business and industry and the relation of the engineer to it. Engineers from all branches of the profession will find the message of interest and enjoy the unusual opportunity afforded them to meet fellow engineers from all parts of the country.

Utah Society of Professional Engineers

OUT of the rich Rocky Mountain Region comes the American Engineering Council's fiftieth member organization. Founded in Salt Lake City in 1907, as the Utah Society of Engineers, the organization functioned under that name until 1935 when its progressive membership reorganized as the Utah Society of Professional Engineers and adopted a revised constitution. The Council is happy to have Utah in the A.E.C. family.

John Deere Gold Medal by A.S.A.E.

THE first award of the John Deere Medal is scheduled for June, 1938. It is to be awarded by the American Society of Agricultural Engineers for original research and development in the soil realm, not from the viewpoint of other sciences, but evaluated in terms of the engineering approach to problems in agriculture. The scope of achievement is broader than the concept of engineering and may draw on the correlative sciences of chemistry, physics, biology; indeed, any sort of science touching the soil, but the word "application" stands as sentinel to demand the passwords of practicality and economic advantage. Thus the award is expected to embrace and encourage all forms of advance fundamental in agricultural progress.

Positions Available

Engineering Societies Employment Service

DESIGNER, 30–35, for heavy machine guns or cannons. Experience in automatic machinery with close tolerances will be considered. Salary, $2000 a year. Apply by letter. Location, New York State. Y-2400.

MECHANICAL ENGINEER, 35–45, to act as chief engineer for railway-supply manufacturer. Experience in locomotive design or as mechanical engineer for railroad is essential. Will have charge of development as well as day-to-day engineering design work. Salary, $6000–$7500 a year. Apply by letter. Location, Pennsylvania. Y-2410.

MECHANICAL ENGINEER, preferably single, with considerable experience in metal-cutting field. Should be qualified to straighten out actual shop-cutting problems. Shop experience and knowledge of design essential. Apply by letter. Location, New York, N. Y. Y-2419.

DESIGNER, graduate of recognized technical school, preferably with master's or doctor's degree. Must have knowledge of chemistry, and 8 or 10 years' experience in design of chemical equipment such as autoclaves, high-temperature reaction kettles, high-pressure reaction bombs, as well as general equipment. Apply by letter giving full details of education and experience, and enclosing recent snapshot. Location, Pennsylvania. Y-2423.

PURCHASING ENGINEER, young. Must have background of college or practical engineering to qualify him to purchase materials in accordance with electrical or mechanical specifications, to follow up progress of work, and able to see directly any changes necessary in specifications prior to delivery of material. Must condense this information for engineering department. Must know sources of supply. Only such applicant will be considered. Salary, $2400 a year. Apply by letter. Location, New York, N. Y. Y-2424.

MECHANICAL ENGINEER with 5 or 6 years' experience in combustion and power-plant operation. Apply by letter. Location, Pennsylvania. Y-2425.

MECHANICAL ENGINEER with 5 or 6 years' experience in mechanical-engineering lines, partially in maintenance and investigation work. Apply by letter. Location, Pennsylvania. Y-2426.

INSTRUCTOR, about 25, graduate mechanical engineer with teaching experience. Master's degree desirable. Salary, $2100 a year. Apply by letter. Location, Pennsylvania. Y-2442.

FOREMAN, 35–40, with experience in assembly of medium and heavy machinery. Apply by letter. Location, New York, N. Y. Y-2447.

DESIGNER with good recent experience in design and construction of turbines for modern high-pressure high-temperature steam, preferably in ranges comparable with 1000–5000 kw capacity. Apply by letter. Location, New York State. Y-2450.

(*Continued on page 110*)

IN THE INDIAN PUEBLO DISTRICT
(En route to A.S.M.E. Spring Meeting at Los Angeles. See pp. 94 and 95.)

DESIGNER, graduate mechanical engineer for design and development work on small mechanisms, specifically projectors. Salary, \$50–\$75 a week. Apply by letter. Location, New York, N. Y. Y-2458.

TIME-STUDY ENGINEER, young, to set up cost system. Salary, \$40 a week. Apply by letter. Only engineer residing within commuting distance of New York, N. Y., will be considered. Y-2459.

SALES ENGINEER, 35–40, with experience in power-plant work. Must know consulting engineers and utilities in New York, N. Y. Salary, \$5000 a year. Apply by letter. Y-2462.

PROFESSOR to direct teaching in industrial organization and administration and in addition other teaching in cost accounting and probably engineering economics. Must be graduate of engineering or business-administration course, and have at least 5 years' experience in manufacturing enterprise in cost control and related problems. Salary, about \$4000 a year for senior position, and less for junior position. Apply by letter. Location, East. Y-2467.

INDUSTRIAL AND SAFETY ENGINEER, mechanical or electrical, 30–35, with industrial experience, particularly in connection with safety work, for manufacturer of electrical appliances such as switches, sockets, etc. Salary, \$300–\$350 a month. Apply by letter. Location, New York, N. Y. Y-2468.

DESIGNER AND DRAFTSMAN for industrial machinery and equipment. Should also have shop experience. Apply by letter. Location, New York, N. Y. Y-2474.

GRADUATE MECHANICAL ENGINEER, about 40, to act as director of sales for large stamping concern. Must have technical as well as manufacturing experience, and be acquainted with outlets where company's product, largely automotive, can be sold. Must also be alert to new products that could be manufactured in plant. Opportunity. Apply by letter. Location, Middle West. Y-2478-C.

GRADUATE MECHANICAL ENGINEER to design special and automatic machines including machines for handling paper products, gauze products, and packaging machinery. Must have 5 years' practical experience in engineering work of type that would serve to prepare him for such work. Evidence of ability to create machines will be given considerable weight. Apply by letter giving complete details as to education and experience. Location, Middle West. Y-2482-C.

DESIGNER, mechanical engineer, 35–40 with experience in automatic machinery. Will direct drafting department of company manufacturing bottles from glass tubes. Salary, \$65–\$75 a week. Apply by letter. Location, New Jersey. Y-2487.

COMBUSTION ENGINEERS to make study of steam generation in power plants, advise on appropriate fuel, make boiler tests, determine load balance, examine radiation, submit comparative cost central-station and isolated-plant operation. Location, New Jersey. Y-2495.

A.S.M.E. Calendar

of Coming Meetings

March 23–25, 1938
National Spring Meeting
Los Angeles, Calif.

May 4–6, 1938
Machine Shop Practice Division Meeting
Rochester, N. Y.

May 6–7, 1938
Textile Division Staple Rayon Conference
Washington, D. C.

June 20–24, 1938
Semi-Annual Meeting
St. Louis, Mo.

Local Sections

Coming Meetings

Akron-Canton: January 20. Y.M.C.A., Akron, Ohio, at 7:30 p.m. Subject: "High-Pressure Variable Delivery Pumps," by H. K. Herman, Vickers, Inc.

Anthracite-Lehigh Valley: January 28. Reading, Pa., at 8:00 p.m. Subject: Small Boiler-Plant Equipment," by W. A. Shoudy, consulting engineer, Orrok, Myers & Shoudy Associates, New York, N. Y.

Baltimore: January 13, 1938. Engineers Club at 8:30 p.m. Subject: Mechanical Power Transmission and Drives," by W. Staniar, mechanical engineer, E. I. du Pont de Nemours & Co. This talk will deal with belts, chain drives, short center drives, clutches, couplings, and gear reductions.

Boston: January 10. Walker Memorial, Massachusetts Institute of Technology, at 7:30 p.m. This will be a joint meeting with the Boston Section of the A.I.M.E. Subject: "Fuels for Today and Tomorrow," by A. C. Fieldner, chief of the technological branch of the Bureau of Mines.

Buffalo: January 13. Aviation Meeting. Speaker: Lawrence D. Bell, Bell Aircraft Co.

Chicago: January 18. Room 812, 211 West Wacker Drive, at 7:30 p.m. Subject: "The Use of the Reynolds Number in Piping Design," by G. A. Gaffert, Sargent & Lundy, Chicago, Ill.

January 11. Room 812, 211 West Wacker Drive, at 7:30 p.m. Subject: "Labor and Management—Industrial Relations," by G. W. Adrianson, manager industrial relations, Commonwealth Edison Company, Chicago, Ill.

January 4. Room 812, 211 West Wacker Drive, 7:30 p.m. (Junior Group Meeting). Subject: "Diesel Engines." Joint Meeting with Manufacturing Division.

Cleveland: January 20. Guild Hall at 8:00 p.m. This is a joint meeting with the National Association of Cost Accountants.

Erie: January 18. Pennsylvania Telephone Auditorium at 8:00 p.m. Subject: "Lightning," by K. B. McEachron, research engineer, General Electric Company.

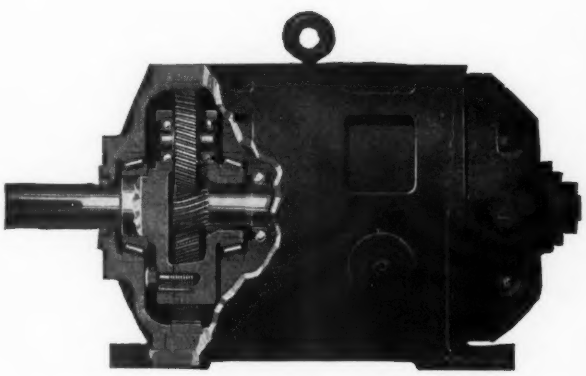
Metropolitan: January 11. Winter Stag Party at 8 p.m., at the Roger Smith Restaurant, 40 East 41st Street, New York City. Tickets \$1.25. For details see box on p. 98.

Mid-Continent: January 17. All-day meeting at the Mayo Hotel, Tulsa, Okla. Subject: "Symposium on Fluid Meters," to be presented by representatives from different oil companies and meter manufacturers in cooperation with the A.S.M.E. Petroleum Division.

North Texas: February 14. Dallas Power & Light Company Auditorium, Dallas Power & Light Building, Dallas, Texas, at 8:00 p.m. Subject: "Mechanical Design of Turbine Unit

(*Continued on page 112*)

STRUCTURAL Simplicity SLASHES MAINTENANCE COST



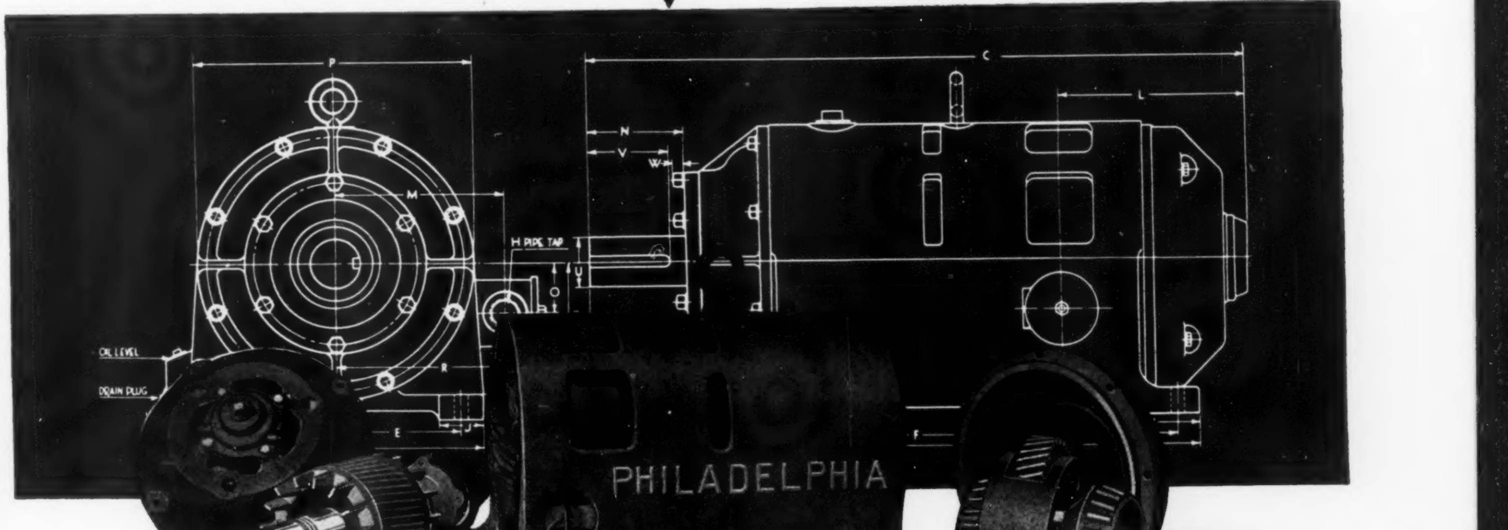
A cutaway view of HS Open Type MotoReduceR

Not over 5 years ago, the idea of an efficient, compact, self-contained combination of Motor and Speed Reduction Unit was treated lightly by industrial buyers, and, no doubt, rightly so. But during that time our engineers experimented, designed and developed the well-known Philadelphia MotoReduceR which, today, is used by the hundreds in practically all lines of American Industry. And, we have been told by countless Engineers that the *structural simplicity* of the MotoReduceR does slash maintenance costs. (Even the most cursory glance at the dismantled MotoReduceR below will convince you of this.)

Consider, too, if you will, the other advantages of the MotoReduceR, such as: *Built-in construction* (one casing) which does away with base plates and flexible coupling; *Ease of installation; Silent, fool-proof operation; Cleanliness; Portability; Easy access to working parts; Neat appearance; Space Saving; Lack of attention required; Perfect Balance* (no overhung parts); *Imperviousness* to dust, dirt, fumes and moisture.

Yes, just consider all these *advantages*, and you will understand why the Philadelphia MotoReduceR is a leader.

Catalog and details upon request.



PHILADELPHIA

MOTOREDUCER

PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducers

ERIE AVENUE AND G STREET, PHILADELPHIA

for Dallas Power & Light Co., Mountain Creek Plant," by Cecil Jordan, assistant manager, turbine department of the Allis-Chalmers Manufacturing Co. This meeting will be held jointly with the Dallas Section of the A.I.E.E.

Norwich: January 24. Allyn Museum, New London, Conn. Subject: "Cast-Iron Crankshafts and Camshafts," by Fred J. Walls, research staff of the International Nickel Company.

Ontario: January 10. Royal York Hotel, Toronto, Ontario, at 7:45 p.m. Joint meeting with the A.S.H.V.E. Ontario Chapter. This will be a dinner meeting as usual, beginning at 6:30 p.m. Subject: "Heat-Insulating Materials and Their Properties," by Prof. E. A. Allcut, mechanical-engineering department, University of Toronto.

Philadelphia: January 25. The Engineers Club, at 7:45 p.m. Subject: "Management." Speaker to be announced.

January 5. The Engineers Club, at 7:45 p.m. Hydraulic Division Meeting. Subject: "Design Trends in High-Pressure Centrifugal Pumps," by Max Spillman, consulting engineer, Worthington Pump and Machinery Corporation.

San Francisco: January 12. Joint meeting with Founder Societies under auspices of San Francisco Engineering Council. Members of other organizations including The American Society of Heating & Ventilating Engineers, The San Francisco Air Conditioning Society, and San Francisco County Medical Society will be most welcome to attend.

Utah: January 29. Inspection trip to new steam power plant of Denver & Rio Grande Western R. R. on 4th South and 5th West Streets, Salt Lake City, Utah. To be followed by technical meeting sponsored jointly by Utah Section of the A.S.M.E., Utah Engineering Council, and Salt Lake City Chamber of Commerce. Durbin Van Law, consulting engineer and member A.S.M.E., will present a paper on "Development of Steam-Generating Equipment for Railroad Service."

Waterbury: January 19. Elton Hotel. Subject: "Labor Situation of Today—Business Side," by J. Goss, Scovill Manufacturing Co.; "Labor Side," by E. Rising, labor editor, *Business Week.*

Worcester: January 11. Sanford Riley Hall, Worcester Polytechnic Institute. Supper at 6:45 p.m.; meeting at 7:45 p.m. Subject: "Business Analysis and Economic Trends," by W. T. Livingston, editor of *Business Conditions Weekly.*

Candidates for Membership in the A.S.M.E.

THE application of each of the candidates listed below is to be voted on after January 25, 1938, provided no objection thereto is made before that date, and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the secretary of The American Society of Mechanical Engineers at once.

NEW APPLICATIONS

Babikian, H. M., Alexandria, Egypt
Bencze, Stephen, New Brunswick, N. J.
Blowney, W. E., Schenectady, N. Y. (Rt & T)
Bogard, Benj. T., Ruston, La.
Brostrom, Fred I., Oakland, Calif.
Cintron, Ralph A., New York, N. Y.
David, Anthony Theo., Brooklyn, N. Y.
Davis, Chas. C., Philadelphia, Pa.
de Camp, L. Sprague, Scranton, Pa.
de Graff, D. J. G., Java, N. E. Indies
Delavan, Nelson B., Des Moines, Iowa
Donoghue, F. Francis, Buffalo, N. Y.
Ellsworth, G. E., Toronto, Ont., Canada
Emswiler, J. E., Ann Arbor, Mich. (Rt)
Fabian, F. G., Jr., Evanston, Ill.
Field, John, Hobart, Tasmania
Fransema, John A., San Francisco, Calif.
Graber, T. N., Boston, Mass.
Harmer, Robt. L., Chicago, Ill.
Heimbrock, Jos. H., Cincinnati, Ohio
Jones, Donald David, Newark, N. J.
Kanter, Jerome J., Chicago, Ill.
Kelting, Clarence A., New York, N. Y. (Rt & T)
Kruse, John R., New York, N. Y.
Manuel, Harold E., Kansas City, Mo.
Moreland, Wm. J., Troy, N. Y.
Mowat, Magnus, St. James' Park, London, England
Olgardt, Jack Paul, Wallace, Idaho
Pacanins, Tomas, Venezuela, S. A.
Peters, J. Clarence, Philadelphia, Pa.
Price, B. B., Chicago, Ill.
Price, John A., Menomonie, Wis.
Quinn, Jas. C., Franklyn Square, L. I., N. Y.
Rajamani, D., Matunga, Bombay
Rodgers, Edw. G., Charleston, W. Va.
Smith, Chas. O., Peoria, Ill.
Smith, Chas. S., East Orange, N. J. (Re)
Soeters, Matthew, Detroit, Mich.
Strong, Harvey W., Detroit, Mich.
Sudranski, L. L., Anderson, Ind.
Symonds, Ralph F., Marblehead, Mass. (Rt & T)
Tripp, Wilson, Manhattan, Kans.
Van Duzer, Robt. M., Jr., Detroit, Mich.
Van Vleet, Jas. G., Buffalo, N. Y.
Wellner, Eric F., Weymouth, Mass.
Wilson, Ralph L., Canton, Ohio
Wood, Geo. H., Allentown, Pa.
Woodward, Elmer E., Rockford, Ill.
Worley, Robt. W., Anderson, Ind. (Rt & T)

CHANGE OF GRADING

Transfer from Member

Harrison, R. E. W., Chambersburg, Pa.

Transfers from Junior

Alberga, Glenn H., Clinton, Mass.
Billeter, Julius, Salt Lake City, Utah
Briscoe, C. B., St. Louis, Mo.
Choraso, Z., Amsterdam, Holland
Garey, Lloyd L., Newark, N. J.
Heavilon, E. B., Cleveland, Ohio
Johnson, Martin M., Brooklyn, N. Y.
Lewis, Francis H., Milwaukee, Wis.
Lindsay, Geo. L., Franklin, Pa.
Ober, Theo. M., Portland, Oregon
Scorah, Ralph L., Columbia, Mo.
Smith, T. E., Atlanta, Ga.
Stevens, W. O., Port Angeles, Wash.
Wells, Herbert, Grosse Pointe Park, Mich.

Necrology

THE deaths of the following members have recently been reported to the office of the Society:

Anthony, Gardner C., November 28, 1937
Coffin, Howard E., November 21, 1937
Field, Frederick C., September, 1937
Forschner, Alfred J., March, 1937
Garsed, Edward T., September, 1937
Hallock, John W., July, 1937
Mosher, Charles D., November 23, 1937
Neureuther, Andrew H., October 16, 1937

A.S.M.E. Transactions for December, 1937

THE December, 1937, issue of the Transactions of the A.S.M.E., which is the *Journal of Applied Mechanics*, contains the following papers:

TECHNICAL PAPERS

Fatigue Life of Tapered Roller Bearings, by W. O. Clinedinst
Modern Aids to Vibration Study, by E. H. Hull
Vibration Stress Measurements in Strong Centrifugal Fields, by C. M. Kearns and R. M. Guerke
Fatigue Failure From Stress Cycles of Varying Amplitude, by B. F. Langer
Recent Investigations in Plastic Torsion, by C. W. MacGregor and J. A. Hrones
Distortion of the Photoelastic Fringe Pattern in an Optically Unbalanced Polariscope, by R. D. Mindlin
The Calculation of Maximum Deflection, Moment, and Shear for Uniformly Loaded Rectangular Plate With Clamped Edges, by I. A. Wojtaszak
The Stability of a Clamped Elliptic Plate Under Uniform Compression, by S. Voinovsky-Krieger

RESEARCH REVIEWS

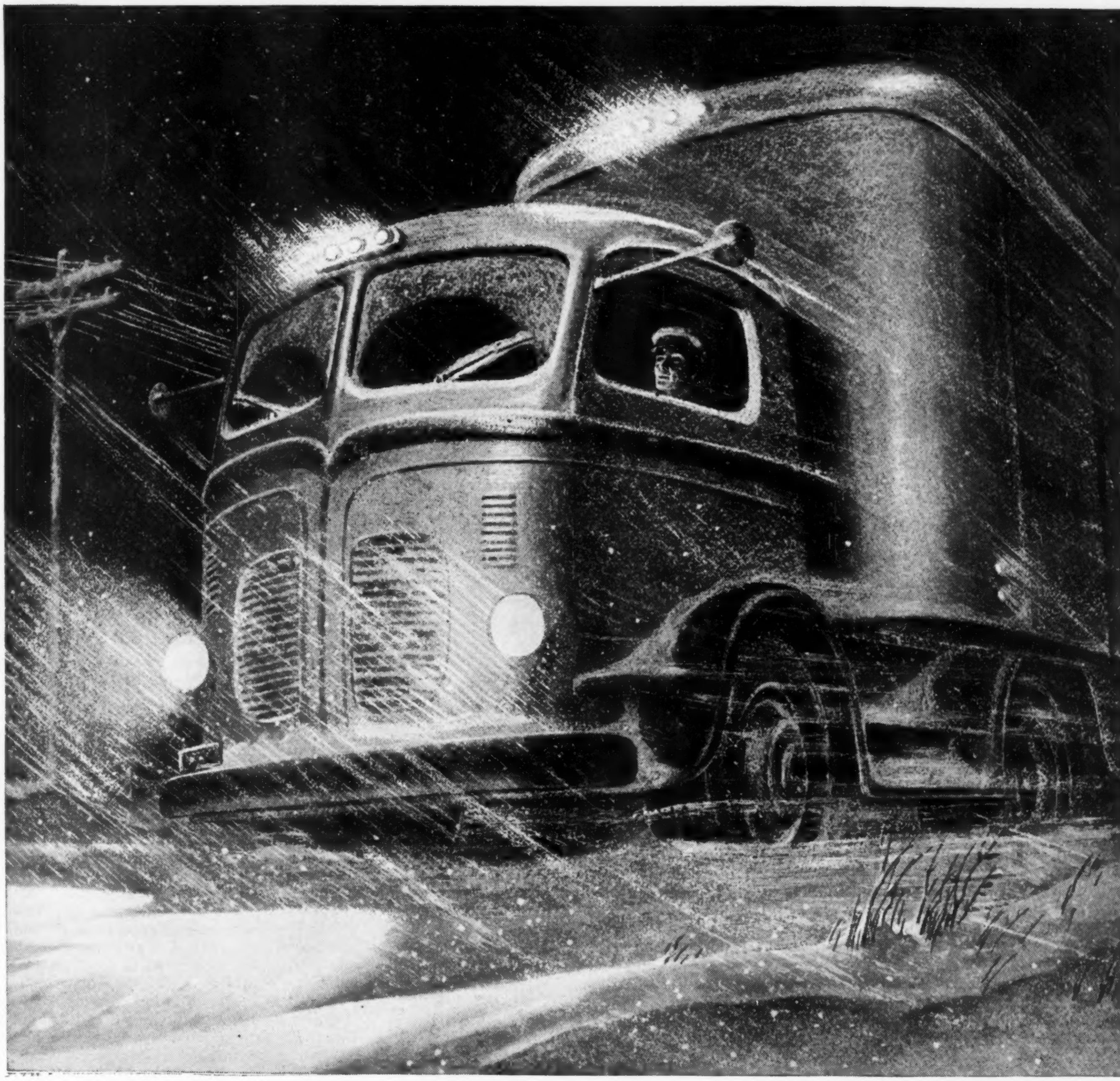
Recent Research in Elasticity, by J. N. Goodier

DESIGN DATA

Design of Press- and Shrink-Fitted Assemblies, by O. J. Horger and C. W. Nelson

BOOK REVIEWS

By J. N. Goodier; S. Timoshenko; I. H. Cowdrey; and J. Ormondroyd.



•Keep Informed . . .

Available literature may be secured by addressing a request to the Advertising Department of MECHANICAL ENGINEERING or by writing direct to the manufacturer and mentioning MECHANICAL ENGINEERING as the source.

Announcements from advertisers in MECHANICAL ENGINEERING and the MECHANICAL CATALOG

• NEW EQUIPMENT

Monel Made with Ebony Finish

Research engineers of the Huntington Works of The International Nickel Company, Inc., 67 Wall Street, New York, N. Y., have produced "Ebonized" Monel with an ebony finish designed for use where appearance must be maintained under temperatures up to 1400° F. The material is identical with standard Monel except that a lustrous "blue-black" finish is imparted in a specialized oxidizing operation. It has been created particularly for a newly designed heat deflector used in Chromalox super-speed range units manufactured by the Edwin L. Wiegand Company.

Element pans, reflectors and deflectors in all electric heating units have been source for complaints because the materials from which they are made invariably suffer heat discoloration or stain and rust. Since this new ebonized metal like standard Monel possesses complete rust immunity and diversified resistance to corrosion in addition to its new ability to resist discoloration from relatively high temperatures, it helps provide insurance against costly replacements and unsightly appearance.

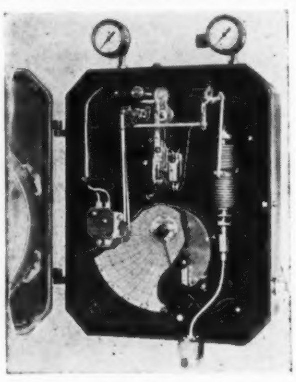
The deflector design is an interesting one. Until now, most heating units were equipped with reflectors—pans of bright materials that tended to reflect heat back up toward the unit. The deflector presumes the operation of a flue. It convects air currents that in turn transmit escaping heat back toward the middle of the element. In this manner the heat is intensified by the up-draft air currents directed by the design of the ebonized Monel deflector. Tests by thermal experts demonstrate that an improved efficiency is obtained with the unit.

New Hancock Blow-Off Valve

The Hancock Valve Division of Manning, Maxwell & Moore, Inc., Bridgeport, Connecticut, announces a full new line of boiler blow-off valves. This new line of Hancock Valves incorporates a number of features including distinctive "Blo-Deflector" protecting lip. The makers claim that this design principle deflects boiler blow so effectively that these new valves are almost indestructible. To further increase the wear-resistance of these Hancocks, they have stainless steel valve discs hardened to 500 Brinell and renewable valve seat rings *heavily Stellited.* It is further claimed by the makers that this combination of hard metals reduces maintenance costs to a minimum. Simplicity of design and fewness of parts are other claims made for these valves.

The illustration shows the unique "Blo-Deflector" protecting lip on the 500 Brinell stainless steel valve disc. The makers state that the "Blo-Deflector" side tracks wear just as a football halfback straight-arms a tackler. In the background is seen a 2-inch straightway type. These new Hancock Blow-Off Valves are made in both straightway and angle types for boiler and economizer pressures up to 1660 pounds in full compliance with A.S.M.E. code requirements. Complete story and other features given in new illustrated bulletin that will be sent on request.

Taylor's New Line of Absolute-Pressure Instruments



The critical relationship which exists between absolute pressure and the physical properties of gases and vapors under low pressure is too frequently ignored. Unless fluctuations in barometric pressure are considered, errors in measurement and serious variations in processing may result from the apparently negligible discrepancy. Advanced engineering practice specifies the absolute-pressure system for low pressure measurement.

Complying with this technological advancement, the Taylor Instrument Companies, Rochester, New York, have just announced a new line of instruments for indicating, recording and controlling absolute pressure.

The absolute pressure element consists of a flexible phosphor-bronze bellows to the inside of which the pressure medium under measurement is communicated. Connected with this assembly, and opposing its action, is a second identical metal bellows which has been evacuated and sealed, thus comprising an atmospheric-pressure compensator.

These instruments are applicable to distillation units, evaporators, condensers, and in general, wherever the corresponding mercury type of gauges can be used—with the exception, of course, of gases or vapors corrosive to the bronze bellows.

New D-C Crane-Hoist Control for Rapid and Safe Lowering

A new direct-current crane-hoist control, which makes use of the rocker-bearing contactors and magnetic-time relays that have proven their stamina in steel-mill service, was announced by the General Electric Company, Schenectady, N. Y., at the 1937 convention of the A.I.S.E.E. Among the features of the new control are high lowering speeds, excellent speed regulation, precise spotting of the hook, protection of both motor and brake from abuse, and maximum safety for the operating crew.

Power consumption is economical because regenerative braking (which returns power to the line) is obtained for any load requiring 30 per cent or greater braking effort. Dynamic braking is also available for emergency stops in case of solenoid brake failure. Automatic control of deceleration by a magnetic-time relay provides safe stopping of loads when lowering. These features make possible high lowering speeds which are limited only by the inherent limitations of the motor. If desired, adjustments can easily be made to provide lower speeds.

Magnetic-time relays are employed to control acceleration in both hoisting and lowering. Accelerating and decelerating relays are independently adjustable. Accurate handling of all loads is assured by low speeds provided for both lowering and lifting.

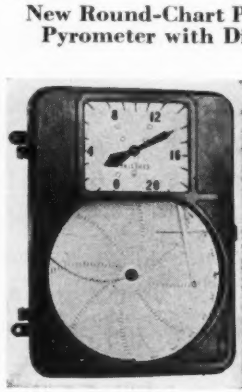
Frosto—New Air Line Freeze Preventative

An additional and improved system of air line and air tool freeze preventative known as "Frosto" is being marketed by the Sullivan Machinery Company to supplement "Tanner Gas" which has proven so successful on construction, industrial and mining operations. Frosto has been developed particularly for industrial applications and wherever electric current is available for its operation. In operation, the Frosto is vaporized in a "vaporizer" and is fed into the compressed air line near the compressor as fast as necessary to prevent freezing of water vapor in the compressed air lines and air tools.

This system is very effective and economical—current consumption is small and thermostatically controlled and only about a quart of Frosto is required to treat 100,000 cubic feet of free air under the worst conditions of temperature and humidity.

Bulletin descriptive of Frosto and Tanner Gas freeze preventative systems can be had on application to Sullivan Machinery Company, 912 Woodland Ave., Michigan City, Indiana.

New Round-Chart Potentiometer Pyrometer with Dial Indicator

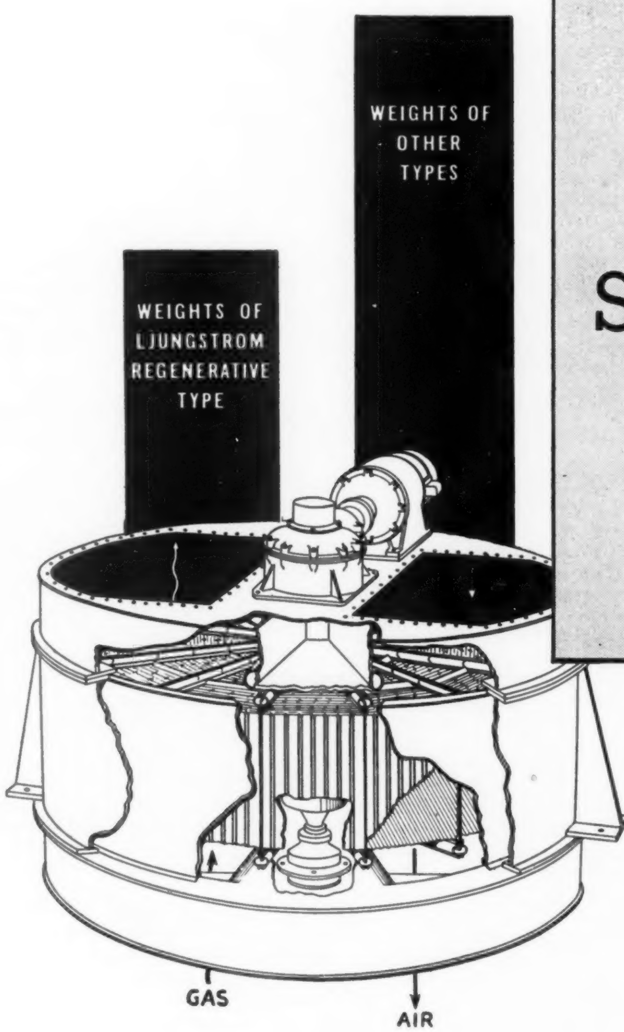


The new potentiometer pyrometer, shown in the illustration, has been recently developed by The Bristol Company, 21 Bridge Street, Waterbury, Connecticut, for recording and indicating thermocouple temperatures. Bristol's Indicating Recording Pyromaster, the name applied to the instrument, provides for direct marking on a 12-inch round-chart and scale indication on a large dial. It employs the potentiometer method of measuring electromotive force in terms of temperature, using standard thermocouples and extension leads, but it operates on a new and simplified prin-

Continued on Page 18

AIR PREHEATERS

For the same high heat recoveries, Ljungstrom regenerative type air preheaters are about one-half of the weight of other types.



A
Light-weight
Air Preheater
reduces the cost
of
Supporting Steel

Ljungstrom

THE
AIR PREHEATER
CORPORATION
Under Management by THE SUPERHEATER CO.
60 East 42nd Street
New York, N. Y.

A-1117

ciple. The new instrument is characterized by the following special features:

1. It is exceedingly rugged—not affected by excessive vibration.

2. There is no mechanical motion of any kind except when a change in temperature occurs.

3. The operating mechanism is simple and compact, consisting of: (1) a highly dampened sensitive Galvanometer, ruggedly pivoted in jewel bearings, (2) a special Relay Unit, actuated by the galvanometer to operate the motor that balances the electromotive force from the thermocouple and positions the recording pen arm and scale indicator, (3) a Standardizing Unit, (4) a "Power Pack" and (5) the Potentiometer or Recording and Indicating Units.

4. The pen arm or indicator is actuated through the relay switches in small steps, at a rate depending upon the rate of change in temperature at the thermocouple.

5. No lubrication is required.

6. The cold-junction compensator is fully automatic. No manual adjustments are necessary.

7. The extreme simplicity of the operating mechanism makes it possible to house the instrument in a standard Bristol's case.

Bristol's Pyromaster is available as a Recorder, Indicator, Recorder with Indicating Scale, Recorder Controller, and as a Recorder Controller with Indicating Scale. Controllers are of either the pneumatic or electric type. A copy of Bulletin No. 489 describing these instruments may be obtained upon request.

Lincoln Announces Electrode for Welding with Small A. C. Transformer Welders

A new mild steel arc welding electrode, designed particularly for use with small alternating current transformer type arc welders which is said to simplify welding with this type of equipment and provide weld metal of high quality, is announced by The Lincoln Electric Company, Coit Road & Kirby Ave., Cleveland, Ohio. The new electrode, designated "Transweld," is the result of extensive research on the part of Lincoln engineers to develop a rod which would meet the special requirements of small A. C. transformer welders.

"Transweld" has a very heavy extruded coating and, unlike ordinary electrodes used with small alternating current welders, has a very stable arc, easy to strike and hold. Because of its stable arc the electrode permits making welds in smooth well-shaped beads. Another advantage is in regard to slag removal. Slag is easily removed from "Transweld" deposits. Weld metal produced by the electrode possesses high physical properties. Tensile strength is 75,000 to 85,000 lbs. per sq. in., yield point 60,000 to 68,000 lbs. per sq. in., and ductility 20 to 30% elongation in two inches.

"Transweld" is suitable for making all types of welds in flat, horizontal, vertical or overhead position. The electrode operates equally well with direct current of either straight or reversed polarity. "Transweld" is made in three sizes: $^3/_{32}$, $^1/_8$ and $^5/_{32}$-inch. The smaller size comes in 12-inch lengths, the other two in 14-inch.

New F-M Pump

A two-stage built-together pump (pump and motor built together) has been developed by Fairbanks, Morse & Co. to operate against heads up to 500 ft.—higher than could be handled by a single-stage unit. In many applications it offers a less expensive alternative for multi-stage and split-case pumps, and its compactness and sturdiness qualify it for portable and semi-portable as well as stationary service.

The new F-M pump is well adapted for all classes of general pumping service with liquids low in viscosity and free from excessive foreign matter. Because of its compact design, the pump is especially advantageous where space is limited. No special foundation is required; the pump is complete in itself and can be mounted in any convenient horizontal, vertical or angular position. Installation is extremely simple.

This new built-together pump, entirely designed and built in one factory, consists essentially of a two-stage centrifugal pump, with enclosed bronze impellers, mounted directly on the shaft of an F-M splash-proof motor. There are no flexible coupling or alignment problems with which to contend. Two rugged ball bearings, an electric motor construction feature pioneered by Fairbanks-Morse many years ago and later adopted by other manufacturers, take all of the radial and unbalanced thrust loads. Impellers for the two stages are placed back to back, compensating thrust. Improved hydraulic design is attained by placing the first stage unit next to the motor and the second stage on the outside, simplifying the cross-over passage and placing the stuffing box under suction instead of pressure. A mounting leg under the pump end gives the unit added stability.

Brass Valves for 350 Pounds Steam

A new line of brass screwed end globe and check valves for 350 pounds steam pressure at 550 degrees temperature is being offered by Crane Co., 836 South Michigan Ave., Chicago, Ill. These valves are designed especially for high pressure steam lines such as are used on oil and gas field boilers for deep well drilling operations. They also may be used on non-shock cold water, oil or gas lines up to 1000 pounds. Their sizes range from $^1/_2$-inch to 2-inches. The globe pattern brass valve (62-P) is of the union bonnet design (except the 2-inch which has a bolted bonnet) and has Crane nickel alloy plug type disc and Exelloy body seat ring. The stuffing box is supplied with a gland and is filled with high grade packing which may be replenished when the valve is wide open and under pressure.

The horizontal lift check valve also has a union bonnet except the 2-inch, which has a bolted cap. Discs are of the piston-guided type and seats are renewable screwed in rings of Crane nickel alloy. The horizontal swing check valve (No. 78-E) which may be used either for horizontal or upward flow, has screwed cap and tapped hole in the body to facilitate regrinding of the disc. In order to have a companion line of brass gate valves for this same service, a 350 pound steam rating at 550 degrees F. has been added to the regular Crane No. 230-H brass gate valves.

• BUSINESS CHANGES

General Electric Plastics Department Opens New Plant at Pittsfield

The Plastics Department of the General Electric Company has recently opened a new molding plant at 1 Plastics Avenue, Pittsfield, Mass., which is entirely devoted to the research, development, design, and manufacture of molded plastics products. Representing an investment of approximately one million dollars, the new plant is the scene of the major part of its plastics activities.

The manufacture of plastics parts by General Electric started over 40 years ago with the production of a few component parts for use on G-E products. In the development of the plastics art and the tremendous increase in the use of plastics parts has come a growth of similar proportions in General Electric activities in this field, until the business has trebled within the last five years.

With the rapid growth of the technique and ability to cope with manufacturing and industrial requirements in plastics, the General Electric management determined to share the benefits of G-E research, engineering and manufacturing experience with other industry. Accordingly, plastics headquarters as set up in Pittsfield include at present about 900 employees with additional plants at Lynn, Mass., Meriden, Conn., and Fort Wayne, Indiana, bringing the total number of G-E people engaged in plastics to well over 1600. Sales offices with Plastics Department Specialists are located at Chicago, New York, Cleveland, Detroit, Lynn, Meriden, and Pittsfield.

The new molding plant at Pittsfield is set up to offer maximum service to its customers, featuring efficiency and speed of operation—the aim of every employee being to pioneer, exploit, and expand General Electric Textolite plastics service to industry.

New Equipment at Morse Plants

In the past few months there's been a stream of new equipment moving into the plants of the Morse Chain Company at Ithaca and Detroit. Now, with a score of new machine tools set up and in operation, production facilities and capacities have been materially stepped up.

Here are some of the tools recently added; two Grinders, one tool & Cutter Grinder, one 52" Boring Mill, eleven Automatic Lathes, two Twin Spindle Drill Presses, two Turrett Lathes and four Gear Cutters.

Morse has also installed new equipment in the heat treating department—one Floating Control Carburizing Furnace, two 60 K.W. Dense Load "Homo" Furnaces, and one 60 K.W. "Homo Carb" Carburizing Furnace. This latter is one of the first of these units. With this new equipment, Morse is now in a better position than ever to serve the industries of the nation.

New Departure Appoints Chicago Office Manager

Mr. Frank J. Miller has been selected by New Departure, Division of General Motors Corporation, as manager of its Chicago sales and engineering office at 230 North Michigan Avenue, succeeding Mr. G. W. Fowler, deceased. Mr. Miller has been associated with New Departure's sales activities in the Chicago territory for over eighteen years. Born in Belt, Montana, July 15th, 1899, he attended school in Chicago and Memphis. His first position, with the Ameri-

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can Sand & Gravel Company, was cut short by the World War when he joined the Navy in 1918. Upon his release from service, he joined Mr. Fowler when he inaugurated the Chicago office in May, 1919. His principal hobby, besides that of his enthusiastic work in the interests of the sale of New Departure products, is golf. Mr. Miller is a member of the Olympia Fields Country Club and the Illinois Athletic Club.

New Falk Representative

The Falk Corporation announces the appointment of The Transmission Engineering Company, 116 New Montgomery Street, San Francisco, as its representative in Northern California. Mr. A. Pedersen will be in charge.

New Allis-Chalmers Branch Office

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has opened a regular office, in Syracuse, New York, at 943 West Genessee Street, with Mr. George H. Carden as Sales Engineer-in-Charge. This office will operate as a branch of the Company's Buffalo District Office of which Mr. H. E. Weiss is Manager.

Jenkins Bros. New Atlanta Branch

With the opening of a new branch office and warehouse, November first, at 376 Spring Street, Atlanta, Georgia, Jenkins Bros. gives Southern users of Jenkins Valves the advantages of close and quick contact with a "local" service branch.

An important function of Branch Manager C. B. Yardley and his staff and stock of repair parts and valves will be to cooperate with Jenkins' distributors in the South, thus enabling distributors to render better service than ever before.

• LATEST CATALOGS

Bristol Multiple Spline Socket Set Screws and Socket Head Cap Screws

The Bristol Company, 21 Bridge Street, Waterbury, Conn., has just published a four-page folder describing its line of Multiple Spline Socket Set Screws and Socket Head Cap Screws. This folder gives general data concerning Bristol line of screws and emphasizes the fact that the multiple spline used is of the same general design as that used in automobiles on the drive-shaft and axles, on the airplane propeller hub and on other modern machines.

Oil Field Equipment

"Oil Field Equipment" is the title of a new 24-page attractive bulletin No. 163 dealing with rotary drilling rigs, mud screens and other oil field equipment developed and built by Allis-Chalmers Manufacturing Company of Milwaukee, Wisconsin. A copy may be obtained by getting in touch with your nearest Allis-Chalmers district office or your supply Company. This well illustrated publication deals fully with the application and use of direct current apparatus in rotary drilling equipment such as full electric rigs, electric-mechanical rigs, and mechanical rigs. It shows typical hookups and installation pictures of these various units and how several of them can be adapted to either two or three engine operations.

Nickel Alloy Steels for Hand Tools

The International Nickel Co., 67 Wall St., New York, N. Y., announce their new bulletin "Nickel Alloy Steels for Hand Tools," just released, which is now available for distribution.

The use of alloy steels for hand tools and small power tools is indicated wherever high strength and toughness combined with light weight, improved wear and fatigue resistance, high impact strength, or better ductility, are demanded.

As the nickel containing steels meet all of these requirements, and in addition respond readily to the usual fabricating operations, they are being widely applied for such tools as wrenches, hammers, chisels, screwdrivers, wood working tools, pliers, rivet sets, saws, knives and lifting jacks.

New Metal Hose Bulletins

Chicago Metal Hose Corporation, 1305 South Third Ave., Chicago, Ill., announces two new bulletins which are now available. Bulletin SH-2 on Rex-Tube and Rex-Weld Steam Hose, also their Metal Hose Bulletin.

How to Select the Right Motor

A new 24-page book has just been published by Century Electric Company, 1806 Pine Street, St. Louis, Mo., presenting in helpful form information concerning the electrical characteristics and descriptions of all types of Fractional Horse Power Motors—Repulsion Start Induction, Split Phase, Capacitor, Polyphase, Direct Current—with suggestions as to how they can be most effectively applied to meet the requirements of motor-driven machinery and appliances operating in normal or abnormal surroundings.

New "Phillie Gear" Catalog

The new Gear Book, just issued by Philadelphia Gear Works, Erie Ave. & G Street, Philadelphia, Pa., is now available. Information and data is given on their stock and standard gears. Also illustrated briefly are a few other "Phillie Gear" products. Contains an engineering data section.

New Sarco Book

The new Sarco Hook-up Book just off the press is an innovation in the steam trapping field. It is based on an accumulation of data over a twenty-five year period and is at least 75% informative material. The principal sections are: 1. Methods for calculating trap sizes. 2. Hook-ups and descriptions of various types of heating systems including unit heaters and air conditioning. 3. Hook-ups for process steam applications. 4. Hook-ups for steam headers. 5. Hook-ups for temperature control. 6. Basic descriptions of the fundamental characteristics of the various types of steam traps, temperature regulators and steam accessories required.

Copies of the book may be obtained from Sarco Company, Inc., 183 Madison Avenue, New York.

Coal Mine Equipment

A concise presentation of equipment for the coal mine, including compressors, rock drills, hoists, pumps and pneumatic tools, is made in a recent 36 page bulletin issued by the Ingersoll-Rand Company, 11 Broadway, New York, N. Y., or any of their branch offices. This bulletin contains condensed tables of dimensions and performance characteristics on all the above mentioned types of coal-mine equipment, as well as a variety of typical installation pictures, and should fill a long-felt need for a consolidated form of this information for handy reference by coal-mine operators.

Timken Bearings for Oil Field Equipment

Designers and builders of all types of equipment used in the oil fields will be interested in the new 52 page supplement to the Timken Engineering Journal. This supplement, which is punched for filing in the standard $8\frac{1}{2}'' \times 11''$, three ring binder, describes and illustrates the various applications of single and double row bearings to steam, gasoline and diesel engines, clutches draw works, transmissions, rotaries, hooks, swivels, blocks and sheaves, geared pumps, pumping units, geared and band wheel pumping powers, pitmans and other miscellaneous equipment commonly used in connection with oil drilling and pumping operations. Special recommendations are given for gasoline, diesel and semi-diesel crankshaft bearings on the basis of explosion pressure and normal engine speed. Copies of this new supplement may be secured free upon request to the Timken Roller Bearing Company, Canton, Ohio.

COMING MEETINGS AND EXPOSITIONS

For the next three months

JANUARY

10–14	Society of Automotive Engineers, Annual Meeting and Engineering Display, Book Cadillac Hotel, Detroit, Mich.
19–22	American Society of Civil Engineers, Annual Meeting, New York, N. Y.
24–26	Institute of Aeronautical Sciences, Annual Meeting, Columbia University, New York, N. Y.
24–28	American Institute of Electrical Engineers, Annual Winter Convention, New York, N. Y.
24–28	American Society of Heating & Ventilating Engineers, Annual Meeting, Hotel Biltmore, New York, N. Y.
25–27	American Society of Refrigerating Engineers, 33rd Annual Meeting, Roosevelt Hotel, New York, N. Y.

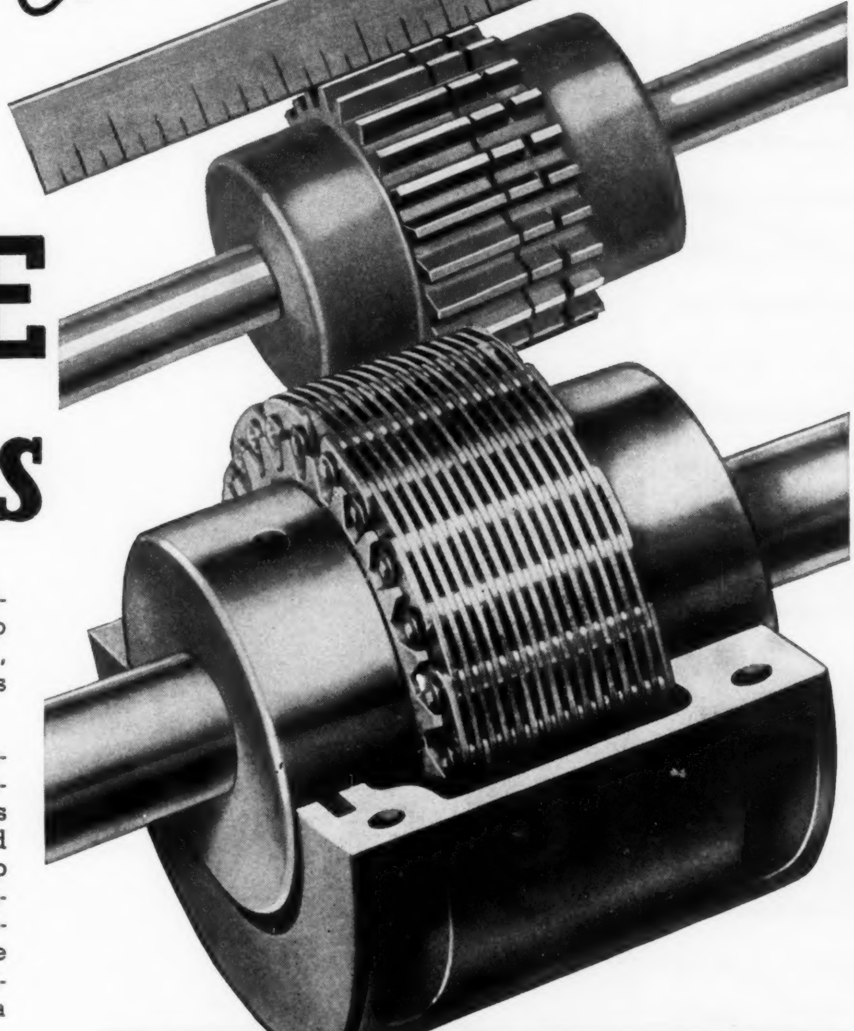
FEBRUARY

14–18	American Institute of Mining & Metallurgical Engineers, Annual Meeting, New York, N. Y.

MARCH

7–11	American Society for Testing Materials, Regional Meeting, Rochester, N. Y.
15–17	American Railway Engineering Association, Annual Meeting, Palmer House, Chicago, Ill.
Wk. of 21	American Society for Metals, Western Metal Congress, Los Angeles, Calif.
23–25	American Society of Mechanical Engineers, Spring Meeting, Los Angeles, Calif.
Wk. of 28	American Ceramic Society, Annual Meeting, Roosevelt Hotel, New Orleans, La.
28–30	Society of Automotive Engineers, National Passenger Car Meeting, Hotel Statler, Detroit, Mich.

Easiest to line up of all *Flexible Couplings*



MORSE
SILENT CHAIN
COUPLINGS

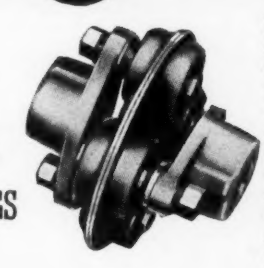
The machined, true faces of Morse Standard Couplings permit quick, easy check-up on alignment. Maintenance men say, "They save us plenty of time because it's no trick at all to line 'em up."

Every power transmission man, inspecting Morse Standard Couplings, will immediately see other advantages of this rugged coupling. The many links and teeth of the flexible silent chain soak up shocks; distribute stresses evenly throughout the coupling. That means greater protection for motor and machine; longer life for the coupling. A single pin makes connection or disconnection the work of a minute.

Split aluminum cover of Morse Standard Couplings is a big safety factor, protecting the coupling and holding lubrication within its grease-tight, machined halves.

Morse Standard Couplings are stocked for immediate delivery in all the most widely used sizes. The Morse Man in your territory, or Morse, Ithaca, will be glad to give you full information on these great couplings for your plant.

MORSE MORFLEX COUPLINGS



Resilient, tough rubber forms the flexing medium of this coupling. Shocks, uneven impulses, sudden reversals are dissipated by the live, non-cold flow rubber blocks set in housings of steel. Maximum distortion and misalignments are compensated without loss of power. The Morse Morflex requires no lubrication, no protection from grit, water, or dirt.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS KELPO CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

The *Standards* COLUMN

News of Interest to Manufacturers

National Standard Safety Code for Cranes, Derricks and Hoists

It is natural that the rise and fall of the business cycle should have a direct effect on the progress made by the technical committees which are organized and function under the sponsorship of the A.S.M.E. This statement applies with some point to the activities of the Sectional Committee on a Safety Code for Cranes, Derricks and Hoists.

The committee was organized in New York on November 4, 1926. J. C. Wheat, at that time Chief Engineer of Industrial Works, Bay City, Mich., was elected to the chairmanship and B. F. Tillson, then Assistant Superintendent of the New Jersey Zinc Company, Franklin, N. J., was elected secretary. At that time its personnel consisted of fifty-seven (57) representatives of twenty-three (23) national organizations, professional societies, and government departments. Subsequently, six subcommittees were formed and the task of preparing the original drafts of the sections of the code dealing with the various types of apparatus was assigned to them. The names of these subcommittees and their chairmen are given below:

Executive Committee, J. C. Wheat, *Chairman*

Subcommittee No. 1 on Overhead and Gantry Cranes, R. H. White, *Chairman*

Subcommittee No. 2 on Locomotive and Tractor Cranes, H. H. Vernon, *Chairman*

Subcommittee No. 3 on Derricks and Hoists, Lewis Price, *Chairman*

Subcommittee No. 4 on Miscellaneous Equipment for Cranes and Hoists, L. W. Hopkins, *Chairman*

Subcommittee No. 5 on Jacks, E. W. Caruthers, *Chairman*

At the organization meeting it was explained that in 1916 the A.S.M.E. Committee on the Protection of Industrial Workers completed and published a Code on Safety Standards for Cranes. During the ten years which followed there were no important developments but the ASA Safety Code Correlating Committee and the American Standards Association gave considerable thought to this subject and were encouraged to take action by the International Association of Industrial Accident Boards and Commissions and the American Museum of Safety. More than 300 firms and organizations interested in the manufacture and use of cranes, derricks and hoists were invited to cooperate and the drafting of the sections of the code dealing with the several types of hoisting equipment was begun and preliminary drafts of sections of the code were prepared and distributed to the members of the sectional committee for criticism and comment in 1932. About this time the country slipped into the down side of the business cycle and it was very difficult to keep up the interest in this project.

About two years ago Dr. M. G. Lloyd, a member of the sectional committee, undertook to edit the several subcommittee reports into a code. Copies of this draft were distributed to industry for criticism and comment in October, 1937.

For further information—address

The American Society of Mechanical Engineers

29 West 39th St., New York, N. Y.